INTELLIGENCE IN THE UNITED STATES

JOHN B. MINER

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A Survey—with conclusions for manpower utilization in education and employment

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TO SALLY

PREFACE

At one time or another, the majority of adults in the United States have taken some type of intelligence test in connection with their education or entry into the Armed Forces or civilian employment. It has not been feasible, however, to assemble the results of this extensive testing and thereby obtain a picture of the intellectual ability of the population as a whole. This is true primarily because of the very multiplicity of the tests employed and the great variety of administering agencies involved. Although sufficient data exist to permit extensive investigation of the development of a great number of special abilities in subgroups of the population and to answer many questions concerned with manpower utilization, the information can probably never be utilized in a systematic manner.

Past studies have most frequently involved special population groups, often as they became available for other than research purposes. The most extensive samples were those tested by the Armed Forces and those tested in connection with the various educational evaluation programs. These investigations have furnished a great deal of information on the intellectual resources of the country, but none has been sufficiently comprehensive to give a complete picture, not even for a single ability.

To obtain a complete picture, the method of choice would be an aptitude census of the whole population, based on a variety of tests of different abilities. Such an undertaking, although certainly possible, would involve rather formidable administrative and financial problems, and may not be practical for many years, if ever. Government sponsorship would be almost essential. It seems probable that adequate estimates of the results of an aptitude census of the United States can be obtained from samples gathered with public opinion interviewing techniques.

The present book contains the results of one such investigation. As so frequently happens in scientific research, the data were originally collected with quite a different purpose in mind. The testing was carried out as part of a two-year research project devoted to the standardiztion of the Tomkins-Horn Picture Arrangement Test (180) (supported under Contract Number DA-49-007-MD-476 by the Medical Research and Development Board, Office of the Surgeon General, Department of the Army). Earlier work with the PAT had indicated that it was important to determine the effects of intelligence on the responses, and for this reason a vocabulary test was included in the standard interview. Only after the collection of these data did it become apparent that we had not only unique information on a projective personality test but also the raw material for an analysis of the utilization of intellectual resourses in the United States.

Although the responsibility for the methodology and theoretical formulations is mine, I wish to express my appreciation and gratitude to those who have spent many hours discussing the subject with me. Chapters III, IV, and V, in essentially their present form, were submitted as a dissertation to the Department of Psychology at Princeton University and the dissertation committee, consisting of Dr. Silvan Tomkins as chairman, Dr. Hadley Cantril, and Dr. Ledyard Tucker, has been of immeasurable assistance. Dr. Douglas Bray, formerly of the Conservation of Human Resources staff and now with the American Telephone and Telegraph Company, read the manuscript and made valuable comments. I owe much to Dr. Russell Carrier for his aid in giving me some understanding of the values, frustrations, and pitfalls inherent in research. For clerical assistance I am indebted to Mrs. Dorothy Fradley, Mrs. Janet Krache, Mrs. Betty Tuttle, and Mrs. Dorothy Baranski, all of the PAT project staff, and to my wife, Sally, who in addition to carrying out the statistical computations has contributed in many other ways to the completion of this manuscript.

Dr. Robert Thorndike of Columbia University has very kindly granted permission to publish the vocabulary test on which this study is based. I am indebted to Dr. David Wechsler and the Psychological Corporation for permission to present certain tabular data, and to Dr. Carl Murchison of the Journal Press for pre-

mission to quote at some length from an article written by Dr. Silvan Tomkins and myself that was first published in the Journal of Psychology. I would also like to express my appreciation to the American Psychological Association for permission to reproduce certain tables.

October, 1956 John B. Miner

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CHAPTER 1

INTELLIGENCE: ITS NATURE AND MEASUREMENT

Over the past fifty years, psychology has increasingly found that one of the major contributions that it can make to society is in the measurement and identification of certain human characteristics. This function of the science has led to a rapid expansion in the number of psychologists in this country, especially since World War II. Testing has taken on an important role in many areas including education, the armed services, industry, and the medical setting. Tests have been developed to investigate the individual's intelligence, his personality, his areas of achievement, and what have been termed his special abilities. They may be used to aid him in making decisions about his educational and occupational future, or to help educators and employers in problems of selection and placement, or to furnish information that may be of value to psychotherapists. In most of these instances, the tests were developed and applied because a need was felt for some technique to answer certain questions, which were most frequently asked not by scientists seeking knowledge about the nature of human behavior and experience but by people whose work in other fields had made them aware of the need for certain types of testing instruments.

It is to the credit of psychology as a whole, but more specifically of those who work in the fields of clinical psychology and psychometrics, that these tests have been developed. Thus, psychology has been able to contribute to the solution of such

practical problems as the selection of students for deferment from the draft and the guidance of young men and women in their choice of a career. Yet, at times it has appeared as if the relationship between test construction and the parent science of psychology was getting lost in the rush to meet the growing popular demand. We tend to forget that tests are of value only in so far as they refer to and measure something that is characteristic of a functioning human being. In developing our instruments, frequently in response to external demands rather than on the basis of theoretical formulations, we have often overlooked problems of rationale and ignored questions dealing with the individual determinants of a subject's response to the stimulus material. Although we can now predict with some accuracy who will have a good chance of graduating from college and who is a good bet for therapy, we know little from our tests of what it really is that makes for successful college performance or what there is about an inkblot that makes a subject respond to it and thereby indicate something about a theoretical no-man's-land called personality. It is at this point that testing is directly tied to psychology as a whole, for only through interaction with the body of knowledge which already exists in the fields of learning, perception, thinking, personality theory, genetic psychology, etc., can we ever hope to find out what in fact we are measuring and what kinds of tests will be most fruitful in adding to our knowledge of a given individual. On the other hand, test results can contribute much in the devising and proving of theoretical concepts of a more general nature.

With the aim, then, of providing a rationale for performance on tests of intellectual ability, some of the factors that seem to be directly involved when a subject answers a test item will be discussed.

Factors in Test Performance

The score that a subject attains on a test of intellectual abilities is a composite result of the interaction of many different processes. At the time of testing, three general groups of determinants within the individual seem to be in operation. The first of these may be described as physical in nature and need concern us little here. That is, test performance will be affected to the extent the subject actually lacks the muscular strength to

write with a pencil, or the visual acuity to see the test items, or the capacity for speech.

A second set of factors, much more diverse than the above, may be defined as distractors. To the extent that consciousness is taken up by thoughts, feelings, perceptions, etc., that are not directly related to the answering of test items, the score obtained will be affected. Lack of motivation, for instance, may manifest itself in positive acts such as looking out the window and wondering who is winning a football game. Other distractors, such as anxiety or depression, may so becloud consciousness that the subject only occasionally gets a glimpse of the problems on the test paper. Again, the subject may suffer from certain physical sensations, such as those produced by sickness or excessive heat, to the point where these usurp a large section of consciousness that otherwise might be devoted to concentration on the test material. The distractors are probably reduced to a minimum if the subject is tested individually (it is then possible to hold him closely to the test material) and if he does not suffer from a neuropsychiatric condition which has as a symptom obsessive thoughts, hallucinations, fantasies, overpowering emotions, or the like. Nevertheless, even under these conditions, distractive effects can not be ruled out completely; in the hospital or clinic setting, particularly, they become so pervasive that intelligence test performance may well be a better indicator of personality attributes than of intelligence per se.

Finally, test performance is a function of the ability (intelligence, talent, etc.) that the individual brings into the testing situation. It is this third variable which has captured the attention of psychologists in the form of controversies over nature-nurture, multiple- versus two-factor theories, the definition of intelligence, and other problems. It seems possible, however, to reduce the body of an individual's experience, which he utilizes in deciding upon his responses, to three concepts: native potential, motivation, and environmental stimulus potential. In elucidating the role that these factors may have in test performance, we may assume that the answer to any item on any test is a direct function of the past experience that the subject can concentrate on the problem. This is as much true of the processes involved in reaching a solution as of the motor or vocal processes involved in communicating the answers. No test item that has ever been

devised taps native potential directly, independent of the past life and learning of the respondent.

Native Potential

It is possible to specify something about the nature of native potential even if it is not reflected directly in test performance. Work in the field of intelligence seems to indicate that native potential is a basic ingredient of the ability to learn and to reason. Some psychologists have placed primary emphasis on learning; others, including the factor analysts, have felt that the crucial variable was the potentiality for complex reasoning. There is, however, no necessary contradiction between these two points of view. Some important experiments carried out by Harlow (76, 77, 78), on what he has termed the development of learning sets, indicate that, with repeated experience in dealing with learning problems of a certain general type, monkeys become more and more adept until they are able to reach a solution on a single trial. This degree of insight is apparently obtained through a gradual increase in the ability to learn, a "learning to learn;" it occurs only with reference to problems of the particular kind practiced and seems to involve the development of an innate learning capacity through experience. It would seem highly probable, as Tomkins (179) has suggested, that a similar development occurs in humans in a variety of spheres so that multiple learning sets are initiated; thus the process that we describe as reasoning or insight may be manifested. Although on the verbal level the two variables, ability to learn and reasoning, may seem quite different, the possibility of reducing them to a common process on the physiological level appears rather promising. It is quite probable that native ability to learn is a characteristic of neural structure or neural chemistry which when exercised (as with the development of a learning set) results in a facilitation of the process of neural interaction; the neural interaction may, in turn, result in what is commonly called reasoning. The theoretical framework presented by Hebb (83) appears to offer a possible method of handling this fusing of the ability to learn and reasoning at the physiological level. Individual differences in native potential could, then, be a function of differences in neuron characteristics that are genetically de-

termined. If these hereditary differences may be labeled as differences in learning ability, the term reasoning might be reserved for developed learning ability or manifest intelligence.

Although the majority of studies indicate a substantial relationship between intelligence as measured and gain with practice (actual learning), this finding is by no means universal. Tilton (178) in a critical review of some of the work in this area suggests a number of reasons for these negative findings. He mentions the fact that the reliability of measures of gain from pretest to post-test must be high to test the theory adequately, and that the ceiling on the tests of learning must be sufficiently high to allow a sizable gain over the practice period. If this latter condition is not met, those scoring high initially, presumably the more intelligent, can not gain nearly as much as those with an initially low score. Another characteristic of the experimental design that must be adequately controlled is related to the difficulty level of the material. If the tasks are relatively simple (as with some motor learning materials) or extremely complex, they are not likely to be sensitive to intelligence differences; in the former case all subjects will learn rapidly, making gains primarily as a function of motivation; and in the latter case most will not learn the task at all. One further criticism of investigations that fail to indicate a positive relationship between intelligence and learning may be illustrated with reference to a study carried out by Simrall (145) involving practice on two sets of items similar to those on the pre- and post-tests. The design called for initial and final testing with two equivalent spatial relations and perceptual tests and the correlation of the gain resulting from experience on the practice items with measures of mental age (Otis). Apparently, however, the design did not allow for any knowledge of results or reinforcement of correct responses. Under such circumstances, one would not expect a high gain-intelligence correlation since the conditions were not such as to foster learning. Unfortunately no information is provided on the degree to which the two forms of the tests were equivalent or on the amount of gain that occurred from the first testing to the second. It appears likely, then, as Tilton has suggested, that in instances in which a relationship between ability to learn and intelligence has not been established, the failure can be attributed to inadequacies in the original design.

It has been stated that native potential when exposed to practice eventuates in reasoning. The evidence for this supplementary definition derives primarily from studies that have indicated the existence of a general factor running through all test performance. Spearman (150) has recently defined this general characteristic of intelligence as a combination of abstraction and neogenesis (the perceiving of relations and inventing of correlates). Rimoldi (138), after carrying out a factor analysis using Thurstone's method on a battery of tests that were all characterized by a high relationship with measures of the general factor, isolated seven primary factors. Two of these, one verbal and one that was not named, are attributed by Rimoldi to impurities in the measures of the general factor. The other five seem to involve plasticity in reasoning, the capacity to find relations, the ability to find relations between likenesses, the ability to educe correlates, and synthesis, all of which are aspects of the reasoning process. Further analysis revealed a second-order general factor behind these primaries that would seem to be almost identical with that described by Spearman. Thus the evidence from what have often been considered two conflicting theoretical positions seems to point to reasoning as manifested in abstraction, perceiving relations, educing correlates, etc., as the crucial factor in intellectual performance.

Start

Motivation to Learn

The second factor that determines the nature and level of the reasoning ability or developed intelligence that an individual brings into the test situation is one of motivation. If no wish to learn exists or if there is actually a wish not to learn, then native potential will not be developed even where the environmental stimulus potential is maximal. A rich environment is only stimulating for those who are able and willing to take advantage of it. Learning sets can not be developed in a motivational vacuum. Weisskopf (192) has discussed at some length a variety of personality conditions that may, especially in childhood, block the development of native potential. Unconscious attempts to punish the parents, a refusal to renounce dependency needs, masochistic tendencies, sexualization of the learning process, and many other factors may operate so that they not only reduce the amount of

school learning that takes place but also produce understimulation in all or almost all areas. Such processes may be perpetuated throughout the life of the individual so that he lives as if in a barren land even though for others the same environment is one of plenty. In other cases, marked changes in intelligence test performance may occur as a result of personality changes and accompanying motivational shifts. Sontag, Baker, and Nelson (146), in their investigation of the factors behind rises and decreases in Stanford-Binet I.Q., suggest that when a passive infantile dependency develops or when a passive feminine role is assumed, motivation for achievement is lacking; test performance will reflect this fact. On the other hand, a shift toward aggressive, competitive, independent modes of behavior will result in increased interaction between the individual and his environment and in a consequent rise in test score. One further cause of a lack of motivation to integrate what the environment offers into perceived patterns (and thus into the learning process) appears to be primarily a function of class and caste differences in attitudes toward learning and education. In general there is nowhere near the same degree of motivation for environmental stimulation in lower and working class families as there is in the middle class; reduced exposure is not just a result of reduced environmental stimulus potential. Frederiksen and Schrader (61) found in their extensive study of veterans admitted to college under the G.I. bill that 80 per cent felt they would have come to college with or without the financial support provided and that an additional 10 per cent felt they *might* have come anyway. The G.I. bill did not, then, expose large groups of working class veterans to a college environment. Probably this is because their earlier training did not include sufficient motivation to seek an expanded stimulation.

Special Abilities and Actual Exposure

Whether or not the third variable, environmental stimulus potential, is put to use in developing native potential depends largely on the degree of motivation. However, neither environmental stimulus potential nor motivation are in any sense ~~unitary~~. A person may be subjected to varying degrees of stimulation in a variety of content areas. It may be that certain areas are not

represented or are under-represented in one environment, as for instance, the materials for mechanical learning in various primitive groups. On the other hand, differential motivation may operate in such a way as to select from a multiple-content environment those areas which develop for some reason a high interest value so that actual exposure, Koffka's behavioral environment, is restricted. For any content area to develop, there must be adequate environmental stimulus potential available *and* the motivation to seek out this area and develop learning sets. The result of the interaction of these two variables (independent of the degree of native potential) may be termed actual exposure in the sense that the environment not only offers opportunity for learning but that the individual is motivated to take advantage of the opportunity.

A study by Janke and Havighurst (92) illustrates rather well the function that motivation may have in the development of special abilities. When all ten-year-olds in a small city were given a variety of tests, class differences in favor of those at the higher levels appeared consistently in both sexes. When, however, these same tests were administered to all sixteen-year-olds, one of these differences, and only one, had disappeared: the higher class boys no longer excelled the lower class groups in performance on a mechanical assembly task. The higher class girls maintained their superiority on a similar test developed to place emphasis on problems facing a housewife. The implication is that the boys of higher status had in many cases lost interest in mechanical learning of this type and concentrated on other areas of achievement presumably as a function of class attitudes. The higher class girls remained interested in household duties and therefore maintained their advantage.

It should be apparent from the discussion ~~so far~~ that I am taking a position similar to that developed ~~initially by Bray (23),~~ ~~namely, that~~ special abilities are not a function of separate, inherited abilities that reside in the organism waiting to be developed, but rather result from a channeling of a unitary native potential into certain content areas. It should be emphasized, however, that the discussion here is limited to intellectual abilities, the utilization of learning sets in order to reason in certain content spheres. It does not apply to physical strength, dexterity, visual acuity, or the like.

This position implies that the differences between tests of aptitude and of achievement are in part a function of the size of the content area sampled. Aptitudes, like achievements, may be considered areas in which learning sets have been developed, achievements being in general more circumscribed. An additional difference which has often been claimed is that achievement tests measure past learning and aptitude tests tap present reasoning ability in a sphere. Actually, both types of tests usually measure both past learning as reflected in information *and* present ability to reason as reflected in problem solving. Any present reasoning ability is presumably a function of learning sets developed in the past and the application of a variety of past experiences to the present problem. Similarly, on tests that purport to measure only past achievement, as the items become more and more difficult for the individual, answers are produced increasingly by present reasoning from whatever learning sets can be brought to bear. This point will be discussed in more detail later when the rationale for tests of vocabulary is presented. Here I want to suggest the following: if tests of aptitude and achievement are constructed to cover the *same* content area, both will measure the degree to which learning sets have been developed; and there will be a high degree of overlap in the processes involved in producing answers. Only in the rare case, in which learning sets have been developed and used in the past but are now nonfunctional and in which the achievement test does in fact contain a great deal of material that is identical with the past learning, will there be a real discrepancy between aptitude and achievement test results based on similar content. This does not imply that aptitude tests cannot be of marked value as predictors over broad areas of content.

Assuming, then, that the degree of actual exposure to a content area is a function of the amount of motivation and the degree of environmental stimulus potential, the following equations may be set up for the extreme cases:

1. high actual exposure + high native potential = high ability
2. low actual exposure + high native potential = low ability
3. high actual exposure + low native potential = low ability
4. low actual exposure + low native potential = low ability

Although these equations should in general hold, I am inclined to believe that equation 3 implies a degree of variability some-

what larger than might be found in 1, 2, and 4, because learning and the development of learning sets take place over time.

A person lacking adequate native potential may, if highly motivated and in an appropriate environment, develop a content area to a point somewhat higher than would be possible for people without such a degree of actual exposure irrespective of their native potential. To what level a person could raise himself relative to the rest of the population and how long it would take him to reach his limit are questions that can not be answered now. However, several implications are apparent. Due to the low native potential, development of a content area would presumably be extremely slow as compared with people who are described by equation 1; learning would absorb much time so that other content areas could not be developed. Except in one or two content areas, the individual might well appear even less intelligent than his native potential would warrant, due to a lack of actual exposure in other spheres. In addition, such a concentration on a special content would probably produce a high level of ability, relative to the rest of the population, in areas in which actual exposure is low for other people and in which, therefore, exposure rather than native potential would allow a competitive advantage. Such abilities are, however, much less apt to be culturally valued and useful. When an ability is important in a society, people will be motivated to achieve it, exposure will be sought out, and native potential will be the primary determinant of the level obtained by each person who competes for this ability. As a result, the special ability developed with high exposure by a low native potential person will ordinarily be rather obscure and highly circumscribed. Further, since learning time to reach a high level relative to the rest of the population is apt to be long, especially if the ability involved is one in which the learner must compete with others of higher native potential, it is questionable whether, assuming a fixed supply of learning facilities, it is economical for a society to attempt to train in this manner. If, in fact, two people with higher potential could be trained to the same level in a given ability in the same time as one person of lower native potential, it would seem advisable to train the two unless facilities were unlimited.

An Example

Before discussing the relationships between various content areas, it seems desirable to elucidate some of the concepts presented with reference to vocabulary. In analyzing this specific content sphere, it is possible to present part of the rationale of the entire study. The second part of the rationale, dealing with vocabulary-education and vocabulary-occupation relationships, will be discussed in Chapter II.

It is clear from the previous discussion that vocabulary tests, although usually classified as measures of verbal ability, are really achievement or information tests according to the conventional definition. They place a heavy emphasis on past learning. If the emphasis is complete, i.e., if the words are so easy that all subjects know them all immediately, and if, in addition, a time limit is imposed, the factor producing a differentiation among scores is apt to be something like perceptual and motor speed. To the extent that difficulty is raised, verbal reasoning is introduced as a differentiator; but as long as speed remains as an element, it is very likely to contaminate the test score with one or more non-intellectual factors. On the other hand, an untimed vocabulary test with some items that are difficult for all those tested is a measure of both present and past reasoning ability. The former will manifest itself on those words that the subject does not know directly but that he can define with the help of related learning. Learning sets of various kinds are brought to bear on the problem, and a reasoned solution is produced. Thus, knowledge of other languages, knowledge of word structure, knowledge of the meaning of some part of the word, the memory of a context in which the word was used, the ability to eliminate certain alternatives under multiple-choice conditions, etc., may operate singly or together to assist the subject in coming to a solution. Such answers may be in part guesses, but they are educated guesses; the person who has developed a high level of verbal ability relative to others will get more answers right as a result of this process than those with a lower level of ability. The individual who can reason when tested must have developed his ability by actual exposure in the verbal content area and thus must have exercised this process in a similar manner in the past to increase his vocabulary. This might not be true, however,

for an individual who, having received his language training in another language, started to learn English shortly before testing; he might well achieve most of his correct answers through reasoning, while a person brought up in an English-speaking home and of equal native potential and actual exposure to language (as a whole) would be able to handle the same items directly on the basis of past learning.

Considering the nature of past learning, it appears probable that vocabulary is learned through a process of reinforced trial and error accompanied by attempts to figure out meanings from written and spoken contexts. Such figuring out or "one-trial learning" is, as Harlow's experiments would suggest, more prevalent at later ages when the rest of the sentence or paragraph is already meaningful, i.e., when learning sets have developed into which the word can be integrated. Even when the meanings are obtained from a dictionary, learning occurs only if appropriate learning sets exist; adequate knowledge must precede to allow the word to have meaning in terms of the synonymous, descriptive words and phrases employed. A word memorized without understanding is not in fact available for use in the subject's written and spoken communication and will almost certainly be forgotten due to lack of exercise. A word *may* be rehearsed without being used; but such behavior is rare, being restricted in all probability to swear words and sex words or a few words which may have extreme personal significance.

The process of reasoning from the verbal context or from definitions is less characteristic of early verbal learning. The child seems continually to try out words, making corrections as he fails to communicate or fails to achieve the series of sounds he is attempting to imitate. Imitation is, of course, facilitated by the fact that certain words are observed to achieve certain ends for other people. Thus, the child's perceptions of his own words and those of others are slowly integrated with other aspects of perceptual experience so that words come to mean things and sensations and feelings and wishes. Then, words begin to serve as the frame of reference within which further meanings can be developed.

Vocabulary tests also seem to possess a certain advantage over other primarily information measures. As was pointed out, a person may occasionally develop learning sets in a content

area and then fail to maintain his ability so that a measure of his past learning is, to the extent it taps specific items previously learned, an inadequate measure of present reasoning ability in the specific sphere. That is, he may retain general principles, but not specific information. This situation is least apt to occur in the verbal area because vocabulary is continually used and exercised. Learning sets and ability to reason are thus kept at a maximal level. Evidence to support this conclusion will be presented in a later chapter when the relationship between vocabulary score and age is brought out. The data suggest rather strongly that vocabulary test score rises slowly in all groups of the population into later maturity and that this rise is greatest in those groups who exercise their verbal ability the most. It is probably for this reason that vocabulary tests have frequently been considered as adequate measures of "verbal aptitude" rather than as achievement tests.

There is, however, some evidence that vocabulary can deteriorate. Capps (30) administered a variety of tests, including the Terman vocabulary, to a group of epileptics who had been rated for the degree of clinical deterioration. Consistent and rather marked decreases in all test scores were found to occur as a function of deterioration. These results could not be explained in terms of differences in age, education, or original intelligence level. Deterioration was found to be reliably but not markedly related to length of hospitalization. The findings suggest that the reduction in environmental stimulus potential in a hospital environment, the loss of motivation to learn as a result of passive acceptance of the disease itself, and possibly also some direct effect on the physiological processes during seizures may all contribute to the general deterioration of mental functioning. Whether or not a similar drop in test score with deterioration occurs in schizophrenics who do not have seizures is almost impossible to determine, since schizophrenics who reach similar levels of deterioration are either untestable or so bothered by distractors that their tests are of doubtful validity. It is apparent, nevertheless, that learning sets can be broken down.

There is also some evidence that vocabulary as a content area is subject to some specialized development with increased actual exposure. Altus (3) administered the Terman vocabulary and Gray Oral Reading Test to a group of Army inductees whose

I.Q.'s ranged from 75 to 79 on an abbreviated Wechsler Scale consisting of the Information, Arithmetic, Similarities, and Comprehension subtests. He found a high relationship between the two tests. The vocabulary scores, however, were within a narrow range, the difference between illiterates and those reading at a seventh grade level being only 5.21 words. Since the mean score obtained by the seventh grade readers is still some three words below the adult mean, there is a strong implication here that either low native potential or correlated but limited actual exposure in several different content areas or both have acted in such a way as to keep the development of all spheres represented on the vocabulary, reading, and Wechsler tests within rather narrow limits relative to the rest of the population.

The Relationship Between Special Abilities

Returning now to the relationship between various abilities, our theory implies that, to the extent actual exposure is equal for a person in a variety of content areas, the abilities will be at the same level, since native potential is unitary and thus contributes equally in all spheres. If, however, actual exposure varies as a result of differences in motivation and/or environmental stimulus potential, then some abilities will presumably be more highly developed than others. Nevertheless, this differential exposure may be a function of value systems that run throughout a society; in such a case, a high correlation between abilities in that society will still remain. Although one ability may be characteristically high in a society and another low on an absolute scale because of differences in exposure that are a function of societal values, an individual's position relative to others will frequently be the same in both cases. This is so because the relative actual exposure in the two content areas is likely to be equally high or equally low. For example, our society tends to consider verbal skills of prime importance and to place less emphasis on numerical abilities. Actual exposure will, therefore, be higher for most people in the verbal sphere than in the mathematical; and native potential will be more fully developed. In spite of the differential development, high correlations between tests would be expected since the differential influences serve only to raise or lower the scores of the majority of the

members of our society on an absolute scale and have no effect on the relative position of individuals within the distributions of verbal and mathematical ability scores.

High correlations between abilities would be predicted, then, because people are exposed in general to environments that are as a whole equally rich or barren. The illiterate is not apt to learn arithmetic or complex mechanical skills. The college graduate is apt to have been exposed to a great variety of content areas. Further, any society to exist must exert some pressure on its members to learn a set of values which govern the behavior and thought within that society. It may well be, also, that the nature of human beings, their primary needs and physical structure, predisposes toward certain approaches to the environment and serves to emphasize certain aspects at the expense of others.

Consequently in the population as a whole we should find a high correlation between those abilities that are felt by the members of the society to be desirable. Less desirable abilities will, on the other hand, show a lower correlation among themselves and with those that are valued in a culture, because members of the society will not be motivated as a group to develop these content areas. Some individuals with less native potential or a restricted environment may, however, seek out these rarer skills and attain a competitive advantage. Thus, we expect little correlation between the more conventional areas and such specialties as weight guessing and burglary. Presumably there is also a rather low correlation between musical talent and the conventional areas, not, however, because of a lack of cultural approval but because playing a musical instrument or singing requires motor skills—dexterity, controlled breathing, etc.—as well as auditory acuity. Artistic talent in so far as it requires learning sets and reasoning would correlate somewhat more highly, although dexterity is not ruled out. The assumption of correlation is to some degree corroborated by the development of drawing tests as measures of intelligence.

In samples that may be considered as representative of the population as a whole, the actual evidence on correlations between abilities is quite limited. Many studies have reported such correlations, but in most cases there is reason to believe that a restriction of range exists that artificially lowers the magnitude of the correlation coefficient for our purposes; e.g., the relation-

ships established between tests of a variety of abilities administered to college students may or may not be the same as those found in the total population. Cronbach (46) in summarizing the literature on this topic indicates that the relationships are far from identical in diverse groups. In questioning the value of correlation coefficients obtained from homogeneous groups as indicators of relationships between abilities in the society as a whole, I do not imply that such measures have no value at all. Frequently, an investigator will be interested only in the correlations as obtained in a certain age or educational group and will not wish to generalize beyond the population sampled. The tendency, however, to generalize to the population as a whole from studies based on extremely homogeneous samples is unfortunate. The factorial structure obtained in one group cannot be assumed to represent that of the total society.

Hagen and Thorndike (74) report results obtained on tests of vocabulary, mechanical comprehension, and arithmetic reasoning from 1,060 respondents who were tested during door-to-door interviews in four East Coast areas, primarily urban. Although the authors do not claim representativeness, the group does at least appear to have more heterogeneity than is usually possible. Vocabulary was found to correlate .59 with arithmetic reasoning and .32 with mechanical comprehension, while the latter two correlated .47. The reliabilities for the vocabulary and arithmetic tests were satisfactory, but the reliability for mechanical comprehension was only .59 (odd-even), a value sufficiently low to make the correlations involved suspect. Thorndike (171) himself suggests that the vocabulary-arithmetic reasoning correlation would be about .70 in the adult male population, and that mechanical comprehension would correlate .65 with arithmetic reasoning and .45 with vocabulary.

In another study, carried out by the Personnel Research Section of the Adjutant General's Office (130) during World War II and reported by Anastasi and Foley (4), a sample of 5,000 men was selected to represent the Army as a whole. The average age was 27 and the mean educational level 9½ years completed. Correlations between AGCT subtests measuring reading and vocabulary, arithmetic computation, arithmetic reasoning, and pattern analysis were found to range from .71 (reading versus pattern analysis) to .90 (the two arithmetic

tests). Reading and arithmetic correlated .81 in both cases; pattern analysis and arithmetic, .73 and .75. The various subtests of the Army Mechanical Aptitude Test correlated with the AGCT in the range .65 to .72. Within the Mechanical Aptitude Test subtests measuring mechanical information, surface development and mechanical comprehension had correlations ranging from .67 to .78. In addition, Altus (2) reports a correlation of .89 between the Terman Vocabulary and the Mechanical Aptitude Test among 315 illiterate inductees, a group that, because of its restricted range, might be expected to show a somewhat lower relationship.

Wechsler's (190) standardization group also offers valuable information, although the data on subtest intercorrelations are presented in terms of restricted age groups. Furthermore, the performance subtests place a great deal of emphasis on perceptual speed, motor ability, immediate memory, and dexterity as well as reasoning in the various content areas. It is therefore almost impossible to determine the contribution of reasoning ability per se. If, however, tests affected by the non-intellectual factors are eliminated and comparisons restricted to the comprehension, information, arithmetic, picture completion, vocabulary and similarities subtests, the results seem to be in line with those previously reported. Wechsler's data are presented in Table I.

Although similar information is not available for less well-known content areas, Thurstone (175) in summarizing the studies that have been done on the relationships between mental abilities points out that correlations have always been found to be positive though in some cases they tend to be quite low. Thus, it seems quite certain that, in so far as tests have been devised to measure the various abilities, and a sufficient variety of subgroups within the population have been tested, development in one content area tends to go along with that in others.

A General Factor

These results are consistent with the expectation that applying the techniques of factor analysis to batteries of tests should produce a general factor. If I am correct in positing a unitary native potential that is channeled into a variety of content areas

TABLE I CORRELATIONS BETWEEN SELECTED WECHSLER ADULT INTELLIGENCE SCALE SUB-TESTS

Test and Age Range	Information	Comprehension	Arithmetic	Similarities	Vocabulary
Comprehension					
18-19	.71				
25-34	.70				
45-54	.74				
Arithmetic					
18-19	.64	.59			
25-34	.66	.49			
45-54	.71	.64			
Similarities					
18-19	.76	.65	.62		
25-34	.70	.62	.55		
45-54	.72	.66	.58		
Vocabulary					
18-19	.81	.71	.64	.78	
25-34	.81	.73	.59	.74	
45-54	.85	.76	.68	.72	
Picture Completion					
18-19	.64	.53	.50	.63	.62
25-34	.67	.56	.50	.56	.61
45-54	.65	.63	.57	.62	.63

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and that thus permits the development of learning sets in these areas to the point at which the individual is able to produce reasoned solutions, then there should result a common element that determines the test performance or, at least, contributes to it. This would not imply that group factors, pointing to common elements in the content of a number of tests, ought not to appear. In so far as tests tap areas that are apt to be exposed together, the tests will be highly correlated, and a group factor should result. If several tests of various arithmetic skills are part of a battery, these tests might be expected to correlate to a somewhat higher degree with each other than with non-arithmetic tests. Motivation and exposure are likely to be the same for

addition, subtraction, multiplication, and division, and an individual taking these tests is likely to perform at about the same level on each.

The principal evidence in opposition to the expectation of a general factor comes from the studies of Thurstone whose criteria for simple structure are such that it is rather difficult to obtain a general factor from the original intertest correlations. His original study of college students (174) led him to contend that there are a number of primary mental abilities. It is apparent that such a homogeneous group is not apt to produce high correlations between the various tests. Nevertheless, Spearman (149), who has been a vigorous proponent of a general factor, reanalyzed the data according to his own method and found that the number of group factors reduced to four—Verbal, Spatial, Numerical, and Memory—and that a general factor did appear. Similarly, Holzinger and Harman (88) applied the bi-factor method to the Thurstone material and also obtained a general factor. The evidence suggests that even in a group with a markedly restricted range of abilities, a general factor can be obtained. Whether or not it will be obtained depends largely on the method used in analysis.

In a second study (177), Thurstone again obtained evidence for a number of primary mental abilities, this time from a group of eighth grade children. However, in this case he found, after analyzing the matrix of intercorrelations between the primary factors, what may be termed a second-order general factor similar to that previously noted in the study by Rimoldi (138). The original verbal factor was found to correlate .715 with this general factor, and inductive reasoning correlated .630. These were the two highest values, although the number factor was also high. A second study was then devised using only the 21 tests from the initial battery of 60 that appeared to be the purest measures of the primary factors; these tests were given to a new sample of eighth graders. By far the highest correlation with the second-order general factor occurred in the case of Inductive Reasoning with a value of .843. Verbal, Number, and Word Fluency correlated .676, .603, and .686 respectively. It is interesting to note that Reasoning shows a consistent high relationship with the general factor in view of the fact that Spearman (150) defines "g" essentially in terms of reasoning.

There are, in addition, several studies employing Thurstone's method that have resulted in the identification of a first-order general factor. Blakey (21) and Wright (201), both using groups of ten-year-olds as subjects, obtained such a general factor, but both were hesitant about identifying it with "g" as Spearman had defined it. Rather, they thought that they had isolated something like maturation, a factor which, although characteristic of their groups, would disappear at a later age. Such a conclusion was felt to be consistent with the presumed absence of the general factor in Thurstone's study of college students. Since Wright's investigation was carried out with the Stanford-Binet, it is possible to check the maturation hypotheses against the results of McNemar's (117) factor analysis of that test. The McNemar study employing the test data from the 1937 standardization is ideally suited to this purpose, since separate factorizations were made at each age level. If the maturation hypothesis is correct, then there should be a reduction in the contribution of the general factor at the higher age levels and, consequently, a proliferation of group factors. Contrary to such an expectation, the general factor was found consistently at all age levels with group factors appearing at ages 2, 2½, 6, and 18.

Thurstone's present position (176) seems to be that a first-order general factor may appear in any set of data but that, with sufficient ingenuity, variables can be devised that do not involve this factor; subsequent studies in which these variables were included would elicit only group factors. Thurstone seems to accept the second-order general factor (175) as in some sense an "energizing factor" which promotes the activity of the many special abilities. The similarity between this point of view and a conception of "g" as resulting from the joint action of motivation and environmental stimulus potential in a variety of areas seems quite apparent. The primary difference lies in the fact that Thurstone seems to suggest that the general factor is a direct result of some function of the human organism, while I would contend that it is a statistical product of correlated actual exposure.

The Differentiation Hypothesis

The second line of evidence running contrary to the expectation of a general factor derives from studies suggesting that

intelligence differentiates into a variety of specific abilities with increasing age. Since a general factor is posited for children, such a theory seems to be in only partial opposition to the point of view taken here. However, the concept of a generally rich or generally barren environment acting in such a way as to aid or suppress the development of many content areas implies that the correlation between such abilities will be high and remain high unless the environment acts to build up learning sets in a differential manner. Such differential effects obviously do occur at the higher educational and occupational levels. However, in these instances, individuals tend to develop a rather circumscribed area of achievement, a highly specialized skill. In such cases, it is almost invariably true that, although these people have overdeveloped one or two achievements, the high degree of actual exposure has influenced more than just the circumscribed areas; such people are apt to have a relatively good general education and to be intelligent in a general sense. In other words, I would contend that specialized abilities are apt to be quite circumscribed and that they are not likely to get too far ahead of the general level of the individual's abilities. An atomic scientist would be expected to possess, as an adult, knowledge of atomic physics that is far superior not only to the knowledge of nearly all the rest of the population but also to the knowledge he possessed as a child. Nevertheless, it is highly probable that he is well-educated in general, and that, relative to the total population, he is able to reason quite well in a variety of content areas.

We may conclude that unless tests of specific occupational information or reasoning problems couched in the vocabulary and setting of highly circumscribed areas are employed there should be very little if any reduction in the correlation of abilities with increasing age, and the general factor should not disappear. To the extent that specialized tests of the type mentioned are employed, correlations will of course drop; a person possessing adequate learning sets in one special area would not be expected to possess them in many other equally limited spheres.

We have seen that the maturation-differentiation hypothesis was not confirmed by a factor analysis of the results obtained during the standardization of the Revised Stanford-Binet. There is, however, a sizable body of evidence that supports the dif-

ferentiation theory. Garrett (68) notes twelve studies that, taken together, suggest high correlations between tests and a sizable general factor at lower age levels but much lower correlations and either a marked decrease in general factor loadings or a total disappearance of "g" at higher age levels. Combining the data reported for these studies, one finds correlations between abilities ranging from .27 to .83 in the nine- through eleven-year-old group; from .10 to .52 in the twelve- through fifteen-year-olds; and from —.09 to .26 in college students. A number of these studies are heavily weighted with tests of immediate memory which seem to account for most of the lowest correlations within each group. Nevertheless, the trend is quite evident throughout. A typical study is that carried out by Clark (41) who administered the Thurstone Primary Mental Abilities Tests to school children aged eleven, thirteen, and fifteen. In all cases except memory, the average correlation between each factor and all other factors decreased steadily with age. Excluding memory, these correlations ranged from .44 to .57 at age eleven; from .40 to .52 at age thirteen; and from .32 to .49 at age fifteen. In another investigation employing subjects from the Wechsler-Bellevue standardization sample, Balinsky (9) carried out factor studies of groups 9, 12, 15, 25 through 29, 35 through 44, and 50 through 59 years of age. Using Thurstone's method, he found a general factor at age 9 and again in the 50 through 59 age group. Subtest intercorrelations dropped from age 9 to a low in the 25 through 29 group and then rose again to reach their highest level in the 50 through 59 group. The samples were selected not to be representative of the population as a whole but rather to be as homogeneous as possible. The three younger groups were all school children in middle class neighborhoods of New York City. The 25 through 29 year olds all had had some high school education, and some had graduated. They are described as being quite homogeneous in intelligence and in fact have the lowest standard deviation of I.Q.'s. The 35 through 44 group had had six to nine years of education, and the 50 through 59 group five to eight years.

There are, however, results that seem to be in direct contradiction to those that suggest differentiation. In the standardization sample for the Wechsler Intelligence Scale for Children (189), the subtest intercorrelations range from .15 to .55 with

a median of .32 at age 7½. At age 10½ the range is .10 to .75 and the median .40 The median then drops again slightly to .35 at age 13½, the range being .13 to .74. Swineford (157) retested two groups of school children, one after one year and the other after two years. Both retests were administered when the children were in the ninth grade. Bi-factor analysis revealed relatively stable verbal and general factors. She found also that the contribution of the general factor to the total test variance increased slightly rather than decreased with age and that this increase was greater for the two-year group than the one-year. In a later study (158) by the same author, sixth and ninth graders were tested; analysis of both groups revealed general, verbal, and spatial factors. In the older group the general factor increased markedly, the verbal factor to a much smaller extent. The spatial factor was constant. These results are in general agreement with those reported by Curtis (47) who found some increase in the contribution of the general factor and a decrease in the total contribution of the group factors in 12-years-olds when compared with a 9-year-old group that was taking the same tests.

In another study, Chen and Chow (37) tested the differentiation hypothesis on groups of students in China. Using Thurstone's method, they found four factors among the fourth graders with an average general factor loading of .42. Among first year junior high school students, the number of factors reduced to three, with the average "g" loading being .58. The tendency toward a reduction in the number of factors continued in the first and second year senior high school students with the isolation of only two factors, the average "g" loading now being .64. The oldest group tested, the college freshmen, had an average loading on the general factor of .59; and that factor was actually the only one found, although there was some evidence for another factor on one test. These results are in direct contradiction to those summarized by Garrett. So also are the results obtained by the English factor analysts Vernon (186) and Burt (29) who report that the general factor is consistently the major contributor to the total test variance even in adults. Since their methods seem to preclude the total disappearance of the general factor in maturity, a study carried out by the staff of the Division of Occupational Analysis, War Manpower Commission (151),

using Thurstone's procedure takes on added significance. Some 59 tests were administered to 2,156 people in various offices of the U. S. Employment Service. Almost half of the subjects were tested in one group. The age range was 17 to 39 with a mean of 23, and all subjects had at least six years of education. For the other eight groups, the age range was the same, but the mean was 28; the average educational level was eleven years. In all nine groups a first-order general factor appeared that had a significant projection on all of the verbal tests, most of the numerical, most of the spatial, a letter series test, a word memory test, and a perceptual relations test.

Although the studies seem to differ markedly in their conclusions, there are several hypotheses that may be offered to explain the contradictory results. Unfortunately, it is impossible to state conclusively what the effect of age on factor patterns is, but a critical analysis of the studies seems to suggest that age has probably very little effect and that, at least for broad content areas, there is not a marked increase in differential actual exposure with increasing age.

Anastasi and Foley (4) have suggested that the crucial factor may very well not be age but education. They point to the fact that in the studies reviewed by Garrett age and education blend almost perfectly. In the Balinsky data the correlations between subtests seem to decrease as education increases, reaching a low point in the most educated group, age 25 through 29, and then rising in the older groups who have less education. A check of the variability of Balinsky's groups indicates, however, that the highest I.Q. standard deviations occur in the younger and oldest age groups. The changes in subtest intercorrelations and general factor loadings, in part at least, may be a function of the degree of homogeneity which Balinsky achieved in selecting his groups. Similarly, there is a tendency for selection to occur as people advance in eduational level. A comparison of grade school students and college students as representative of children and adults is bound to be spurious to the extent the college group is a highly selected segment of those who start out in grade school. It is practically certain that the college students, being more homogeneous in ability, will have lower intertest correlations than the much more heterogeneous grade school students. This

consideration seems adequate to account for the comparisons involving college students presented by Garrett. It is much less apt to account for comparisons involving age groups below the compulsory school attendance age of 16, as for instance in Clark's study.

Another hypothesis is concerned with the problem of the effect of test difficulty on factor patterns. Earlier, I mentioned the fact that a vocabulary test, if quite easy and somewhat speeded, might become a measure of something like perceptual speed rather than of the development of a specific content area. If a number of tests of different abilities are included in a battery and all are quite easy for the group tested, then all will measure perceptual speed rather than a variety of content areas. Since all test scores are based on the same skill, the tests will correlate quite highly; factor analysis will reveal a general factor that, of course, results not from correlated actual exposure in different spheres but from the importance of perceptual speed in all tests. The tests will not actually measure the abilities they were designed to measure. On the other hand, if the tests are difficult for the group, they will be answered on the basis of the learning sets the individual has in the various content areas. Should the level of difficulty become too high for the whole group, guessing may become a crucial factor. When the whole group is guessing, the correlation between tests will approach .00; a high score on one test need not have any relation to the score on another. A similar result will occur if there is no guessing, since the range will be restricted to the extreme low end of the scale. If only part of the group guesses, it will do better on all tests and consequently a high intercorrelation between subtests may be produced and a general factor occur which might be labeled something like "gambling spirit." On strictly power tests when no time limit is imposed, extremely easy material tends to produce a restriction of range to the high end of the scale with the result that intertest correlations are reduced.

It should be apparent from what has been said, that the comparison of the factor patterns of two age groups on the same test may produce very little information that is relevant to the differenitation hypothesis. The same material may have a very different difficulty level when administered to, say, eleven-year-

olds and fifteen-year-olds, and the intercorrelations and factor patterns will vary accordingly.

The empirical evidence on the relationship of difficulty level and factor patterns has been reviewed by Curtis (47). He concludes that factor patterns and subtest intercorrelations are affected by the difficulty of the tests and that the same test may measure one ability on one difficulty level and another ability on another difficulty level. In addition, he carried out an experimental test of this hypothesis by administering easy and hard forms of the same battery of tests to a nine-year-old and a twelve-year-old group. The easy tests were constructed to be as difficult for the nine-year-olds as the hard ones were for the twelve-year-olds. In the nine-year-old group, the contribution of the general factor decreased 15.6 per cent with the harder test. For the twelve-year-olds, the corresponding figure was 12.9 per cent. As might be expected, the more difficult material results in a decrease in the general factor and an increase in the number and contribution of group factors. When difficulty was held relatively constant by comparing the easy form on the younger group with the harder form on the older group, there was practically no change in the contribution of the general factor to the variance of the tests. The sum of the group factors did decrease some 16.2 per cent with the increase in age.

It seems probable then that the contradictions previously noted can be explained in part by the failure to equate test difficulty in the groups compared. When such equating is attempted as part of the experimental design, no change in the general factor seems to occur with age; unfortunately it is impossible to do any more than speculate on the difficulty level of most of the tests used in past investigations. In addition, if the tests are in general quite easy for a group, the degree to which they are speeded takes on added significance. If they are very difficult, some knowledge of the role that guessing had in the test results would be needed. Probably the rather extreme results obtained by Chen and Chow (37) are largely a function of differences in difficulty level, with the tests being appropriate enough for the younger groups but much too easy for the high school and college students.

Whatever the final outcome of the controversy over the differentiation hypothesis, we can be quite sure that the general

factor will be found, if appropriate techniques for its discovery are used, in all age groups and that, although it may be somewhat more marked in one group than in another, it will still be the major contributor to the total test variance at all age levels. This conclusion seems to be consistent with most of the literature dealing with the existence of "g," the correlation of abilities in the population as a whole, and the effects of age on general factor loadings.

CHAPTER 2

VERBAL ABILITY AND THE SOCIAL SYSTEM

The first chapter gave a good deal of space to a discussion of the development of learning sets in the verbal sphere and to the factors that are involved in performance on a vocabulary test. It set the scene for the empirical data that are to follow. However, a second reason for the discussion was the extreme importance that verbal skills do in fact have in our society, as reflected in the high relationship that exists between measures of vocabulary and more comprehensive tests of *general intelligence.*

Table II presents a survey of the results of a number of studies that had as a primary or secondary purpose the investigation of the degree of relationship between a vocabulary test and some general measure, such as the 1916 Stanford Binet, the 1937 Stanford Binet, the Wechsler-Bellevue Scales, the General Classification Tests developed by the Armed Services, the Wechsler Intelligence Scale for Children, and the Otis Tests. Some 21 different studies are involved, based on tests administered to a variety of types of subjects. This list is quite possibly incomplete, but it is probably representative of the results in this area. The median correlation is .83, a very respectable figure and quite consistent with the values of .81 obtained from the 1937 Stanford-Binet standardization sample and .85 (eta) obtained from the Wechsler-Bellevue standardization sample. Terman and Merrill (164) report that the vocabulary test is the most valuable individual measure of the ninety some different types of tests included in the two forms of the Stanford-Binet. Wechsler (188) initially excluded

Table II Correlations of Various Vocabulary Tests with Tests of General Intelligence

Vocabulary Measure	Intelligence Measure	Subjects	N	r	Source
Terman, 1916	1916 Binet	School children	631	.91	Terman (160)
Terman, 1916	1916 Binet	School children	269	.87	Mahan and Witmer (111)
Terman, 1916	1916 Binet	Hospital patients	70	.81	Weisenburg, Roe, and McBride (191)
Terman, 1916	1916 Binet	Psychiatric patients (Diagnostic groups)		.76-.92	Roe and Shakow (139)
Terman, 1937	1937 Binet	School children	89	.91	Spache (148)
Terman, 1937	1937 Binet	School children	65	.92	Spache (147)
Terman, 1937	1937 Binet	School children	1161	.98	Elwood (55)
Terman, 1937	1937 Binet	School children	753	.86	White (194)
Terman, 1937	1937 Binet	Standardization sample		.81	Terman and Merrill (164)
Terman, 1937	1937 Binet	Standardization sample Age 8	203	.71	McNemar (117)
Terman, 1937	1937 Binet	Standardization sample Age 11	204	.83	McNemar (117)
Terman, 1937	1937 Binet	Standardization sample Age 14	202	.86	McNemar (117)
Terman, 1937	1937 Binet	Standardization sample Age 18	101	.83	McNemar (117)
Terman, 1937	1937 Binet	Senior medical students	87	.63	Mitchell (121)
Terman, 1937	AGCT	Army inductees	100+	.88	Altus (2)
Terman, 1937	Wechsler	Psychiatric patients	268	.78	Rabin (135)
Terman, 1937	Wechsler	Psychiatric patients (Diagnostic groups)		.75-.98	Rabin (135)
Terman, 1937, 15 item	GCT	Naval recruits	528	.80	Hunt et al. (89)
Terman, 1937, 15 item	GCT	Naval recruits	445	.61	Hunt and French (96)
Terman, 1937, 15 item	GCT	Naval recruits	487	.67	Hunt and French (90)
Terman, 1937, 15 item	GCT	Naval recruits	487	.72	Hunt and French (90)
Wechsler	Wechsler	Standardization sample		.85	Wechsler (188)
Wechsler	Wechsler	Adult males	1000	.82	Lewinski (102)
Wechsler, children	WISC	Standardization sample Age 7½	200	.71	Wechsler (189)
Wechsler, children	WISC	Standardization sample Age 10½	200	.87	Wechsler (189)
Wechsler, children	WISC	Standardization sample Age 13½	200	.78	Wechsler (189)
Wechsler	WAIS	Standardization samples		.82-.83	Wechsler (190)
Immediate Test	Otis	Reformatory inmates	50	.82	Corsini (43)
Immediate Test	Otis	Reformatory inmates	50	.77	Corsini (43)
Immediate Test	1937 Binet	Reformatory inmates	104	.83	Corsini (43)
Immediate Test	Wechsler	Prison inmates	100	.89	Corsini (43)
Immediate Test	Wechsler	Prison inmates	300	.90	Corsini (43)
Immediate Test	Wechsler, II	Prison inmates	100	.84	Corsini (43)
Shipley	Wechsler	Psychiatric patients	100	.58	Lewinski (101)
Raven	1937 Binet	School children	150	.93	Raven (137)
Thorndike	1916 Binet	Hospital patients	70	.62	Weisenburg, Roe, and McBride (191)

vocabulary because he felt it might be unfair to illiterates and those with a foreign language background, further experience lead him to recommend it as "an excellent measure of . . . general intelligence," and to suggest its inclusion in the Wechsler-Bellevue Scales as a regular measure.

Tests of *General Intelligence*

The median correlation coefficient of .83 just mentioned takes on added signifiance when it is compared with the material Wechsler presents on the relationship between the Wechsler-Bellevue Full Scale and other measures of *general intelligence.* He notes fifteen "r" values obtained by different investigators from a variety of different types of subjects. The range is from .39 to .93 with a median of .73. The fact that the samples described are rather small, and that some of the lower values are based on intelligence measures that are no longer widely used, may have reduced the median estimate somewhat below the estimate that would be obtained with more extensive research. Nevertheless, it appears quite clear that a single measure, which in most cases can be completed in less than fifteen minutes, correlates at least as well with tests of *general intelligence,* which take an hour or more to administer, as these more comprehensive instruments correlate with each other.

There are presumably a number of reasons for this, but one of the most important is the high verbal loading of tests of *general intelligence.* High verbal loading does not mean a heavy emphasis on vocabulary tests per se. Tests of *general intelligence,* however, include tests of verbal reasoning, information, reading comprehension, arithmetic problems, etc., which, although they may tap content areas other than the verbal, require the development of adequate verbal learning sets. In addition, the fact that instructions are conveyed in words, either written or spoken, puts a sort of verbal lower bound to any performance on the test at all. This factor does not operate entirely at the lowest level, however. The understanding of directions is in itself a reasoning problem couched in verbal form; to the extent appropriate prior learning is lacking, directions may be wrongly or incompletely understood and scores depressed accordingly.

A second factor, which is an extension of the first, is the high correlation that exists in the population between various abilities.

Vocabulary and reading skills are apt to be developed together in our society because high actual exposure to one is likely to occur in association with high actual exposure to the other. Accordingly, a sizeable correlation might be expected. Arithmetic, too, is taught in school; although some differential motivation may be involved, we would expect a child who does well in reading to be interested in and take advantage of available opportunities to develop learning sets in the numerical area also, possibly because of class values set on scholastic achievement in all subjects taught. Again, a high correlation might be expected. Finally, middle class children with their characteristically strong motivation to school success are exposed frequently to toys that involve manipulation, such as puzzles, blocks, etc., while similar toys are much less available to lower class children. Thus, the middle class children can develop their unitary native potential also in the area of spatial visualization as required by certain performance tests. The correlations will drop a little more in this case, partly because of differential motivation, partly because motor speed and motor dexterity are introduced above and beyond spatial reasoning, and these motor skills have a rather low correlation with reasoning skills. If spatial tests using drawings as the stimulus are employed, thus eliminating the motor factor, the correlations might be expected to rise; and in fact they do.

In briefly discussing factors that may lead to correlations between content areas, I have indicated how certain spheres are exposed together because the stimuli tend to exist in essentially the same environment and because certain social values make motivation for actual exposure rather general. There is good reason to believe that, to the extent actual exposure operates to develop native potential in the area of vocabulary, it also operates in other spheres. The relationship is by no means perfect, but it is high. Vocabulary tends to be a good predictor of other abilities, all of which may be sampled in the more comprehensive tests. These other abilities may be measured by tests very similar to vocabulary tests, e.g., verbal analogies and reading comprehension measures, or by quite different techniques, such as the mechanical assembly tests. The verbal items, however, are apt to be in much greater abundance, and verbal skills will be required in understanding directions. It is not surprising, then, that vocabulary turns out to be about as good an indicator of *general intelligence*, as the tests of *general intelligence* themselves.

Under different cultural conditions this situation could be changed drastically. If we chose to specialize the training of children by having one group taught numerical skills, another group spatial skills, and another verbal, then the correlation between abilities would disappear; and at the same time our generalized cultural emphasis on verbal ability would be lost. Intelligence tests would have to be devised that placed much less emphasis on verbal material, possibly using non-verbal directions; a measure of *general intelligence* would be meaningless since it would be impossible to obtain a general factor. None of these conditions exists, in fact, at present. Tests of general intelligence are heavily weighted with verbal items, because skill in the verbal sphere is prerequisite for many things that the culture values. Through the techniques of correlation and item analysis we have developed tests that mirror the society as a whole. A non-verbal intelligence test would not accurately reflect the present structure of our society. Whether or not the drastic changes in training of children noted would produce a more efficient society will be discussed at some length later. The important point is that we appear to have at the present time not a society of specialists but a society of generalists with the verbal content area supreme. It may be that such a structure is a necessary condition for democratic processes. A large segment of a society probably must have the ability to evaluate a variety of issues expressed in verbal terms in order to maintain a government of elected representatives.

The reason for the emphasis on the verbal sphere in our society is not difficult to find. Communication requires some type of symbolism; and once a language is developed, it tends to be put to use when communication is desired. As society becomes more complex, there is an increasing demand for verbal skill, because language is the major medium for making the knowledge of individuals part of the general knowledge. Industrialization and scientific advancement are greatly facilitated when people can adequately communicate their experiences to others in verbal terms. Since information is transmitted largely by combining words into certain meaningful arrangements and is received and understood through a process that has been termed verbal comprehension, verbal learning sets tend to be employed extensively even in situations where the reasoning process is primarily spatial or numerical.

Tomkins (179) points out, however, that motivation and environmental stimulus potential are not the same for all people in our society, and native potential is, therefore, not given an equal opportunity to develop in all social groups. Lower class children may be motivated to communicate only to the extent required for the satisfaction of primary needs. Middle class children must attain a much higher level of verbal skill if they are to attain the roles that their class values define as desirable. The people who have the important roles in our society are not necessarily the ones with the highest native potential but rather the ones with relatively high actual intelligence; they have actuated their native potential and have been able, through their development of the verbal content area, to take advantage of the knowledge acquired by others and to communicate their own reasoned solutions to others.

There is apparently no advantage inherent in verbal reasoning over numerical, mechanical, spatial, etc., except that it is frequently easier to think in the terms in which communication occurs. Because of the added function of communication, however, the verbal sphere takes on an importance which the other content areas do not possess in any society that has a large body of accumulated knowledge. It is quite possible that we could develop a more efficient language than we now have. This would require new intelligence tests, but would not invalidate any conclusions as applied to language in general. In so far as language is both an important content area and a method of mediating knowledge in other spheres, verbal ability is bound to hold a position of preeminence among the intellectual skills. Without prior learning of language, many other abilities can not be developed; and the level to which the other abilities are developed depends in part on the level of the capacity for communication.

The Prediction of Scholastic Success

In indicating the role that verbal ability has in educational prediction, no attempt will be made to review the very comprehensive literature that has grown up in this area. I believe, and most educators would probably agree, that the verbal content area is by far the most important in our educational system. Just as the understanding of test directions requires a certain level of verbal competence, so classroom learning depends on the ability

to understand and manipulate material which is transmitted by means of the written and spoken word. Verbal learning sets are necessary not only for reading, spelling, grammar, and literature but also for arithmetic, science, commercial courses, and mechanical drawing. Communication and the teaching process are verbal in nature. In the case of the latter group of courses, however, content areas other than the verbal may also be important. Thus, our school system is in many ways analogous to the tests of *general intelligence:* both are heavily weighted with verbal content; both have certain courses or subtests which tap other abilities but require a certain level of verbal skill for adequate performance.

As the individual progresses through the educational system, the emphasis on verbal learning declines. The percentage of the curriculum devoted to primarily verbal subject matter decreases so that at the college level many more courses of a less verbal nature are offered. Apparently, it is necessary to develop adequate verbal learning sets before these sets can be used to mediate other content areas. An individual with poorly developed learning sets of a verbal nature is likely to have difficulty with his course work and frequently will leave school when he reaches the age at which attendance is no longer necessary or soon thereafter. Probably very few students who are deficient in verbal learning sets are able to surmount the hurdles placed in the way of college attendance. Since college admission is commonly based on high school grades and aptitude tests, both with a high verbal loading, the college group probably has a rather high degree of homogeneity in terms of verbal ability

In describing the relationship between various abilities and scholastic success, it would appear that we now have an educational system that sets certain minimum requirements in terms of verbal skill for adequate performance at the various grade levels. Certain subjects, such as languages and literature, require additional increments of verbal ability for success; the students with the highest scores on vocabulary and similar tests would be expected to get the highest marks, assuming adequate motivation and grading procedures. In other subjects, verbal ability should be less important, and tests of other abilities, such as spatial or numerical skills, will become valuable predictors of success; verbal ability, however, may still be expected to correlate to some extent with marks. If the group is unselected on the verbal factor, as is

a grade school arithmetic class, the correlation between a test of vocabulary and final grades might be expected to be quite high, because many pupils would fail because of inadequate verbal learning sets. If, on the other hand, college grades in mathematics were the criterion, the predictive value of the vocabulary test would be markedly reduced, because the group, previously selected on the basis of verbal achievement, would be quite homogeneous on this factor. Numerical ability would presumably be the best predictor. Verbal ability would still remain a predictor because of its correlation with other abilities and because, even in such a homogeneous group, small increments in the ability to grasp and communicate information in verbal terms should be of value.

If the whole population is taken as a base, verbal ability would be a very good predictor of educational attainment, since it sets a rough limit on the level that an individual can attain. If, however, a student develops the verbal sphere so that he meets the minimum standard for adequate high school or college work, then other abilities become important for success to the extent that courses of a less verbal nature are elected or required. In courses with verbal content, the primary differentiator continues to be verbal ability. The selection of the best predictor or combination of predictors is always a function of the thing to be predicted and the range of ability. If this range is large, a test of vocabulary should contribute substantially to the predictive process.

Evidence on Scholastic Prediction

Below the college level, there is consistent evidence of the importance of verbal ability for scholastic success. Wenger, Holzinger, and Harman (193) gave a battery of tests to school children between the ages of 10½ and 13½ years and analyzed their results, employing both the bi-factor and Thurstone methods of factor analysis. Using estimates of the scores made on each factor, they found that the general factor obtained by the bi-factor method was much more efficient in predicting grades than the group factors. When the Thurstone technique was employed and only group factors were extracted, the verbal factor was the best predictor among them, showing correlations with school subjects about equal to those of the general factor obtained in the bi-factor analysis. This suggests that, to the extent tests with

high "g" loadings are verbal in nature, the general factor will be a good predictor of school grades.

A study in France by Pichot and Rennes (133) with 263 sixth grade students seems to substantiate this point. The Progressive Matrices, often considered one of the best tests of Spearman's "g," and a vocabulary test were correlated with final grades. While the vocabulary test gave a correlation of .57, the Progressive Matrices, which are non-verbal in nature, correlated only .15. The vocabulary test exhibited equal superiority in the prediction of achievement tests scores. It appears that "g" defined independently of the verbal component loses the predictive value Wenger, Holzinger, and Harman ascribe to it.

In another investigation, Shaw (142) administered the Thurstone Primary Mental Abilities Tests to a group of ninth graders along with a variety of achievement tests that were selected to measure school knowledge in natural science, English, mathematics, social studies, etc. He found that the only predictors of any value were the verbal and reasoning factors. The former correlated with the various achievement tests in the range .40 to .79, and the latter .20 to .56.

Similar results are reported for college students by Goodman (72) who, after reviewing a number of studies carried out at Pennsylvania State College, concludes that, when the Primary Mental Abilities Tests are used as predictors, the verbal factor consistently gives the highest correlation with course and average grades. Mitchell (121) found that at the State University of Iowa the 1937 Stanford-Binet, which is largely verbal in nature especially at the upper levels, correlated .64 with freshman grades. The correlation, however, dropped to .15 when an attempt was made to predict the grades of senior Medical School students at the same university. The Terman vocabulary test correlated .04, the Otis Self Administering Higher Form .15, and the Moss Medical Aptitude Test .18—a demonstration of what can happen to the predictive value of any test, even one devised to measure the specific abilities involved, when the tests are not sufficiently difficult and the group too homogeneous to allow sufficient variability in the test scores. In addition, there is a real question about the ability of any grader to make reliable discriminations between the achievements of a very select group such as medical students.

Further evidence for the importance of verbal ability comes

from Dyer's (52) review of some of the results of the College Entrance Examination Board tests. The Scholastic Aptitude Test Verbal Section was found to have a correlation of .44 with freshman grades in eight colleges, while the Mathematics Section correlated .28. If a distinction is made between different fields of study, the picture changes somewhat. For liberal arts students the SAT-Verbal correlates .50 with freshman grades, and the SAT-Mathematical .37, for business students the values are .55 and .34; for the students in engineering and the sciences they are .45 and .47, with the Mathematics Section becoming as good or better than the Verbal. The two Scholastic Aptitude Tests correlated .58 on the 34,935 candidates tested in the March, 1952, series. In another study, using first-term grades as a criterion, it was found that the SAT-Verbal correlated .42 and the SAT-Mathematical .52 with grades in five engineering schools. In one of these schools, however, the test of verbal ability was a better predictor than the mathematical test. The results confirm the expectation that, as specialized areas of a more or less non-verbal nature are introduced into the curriculum, abilities other than the verbal will take on an increasing significance.

A factor analysis of entrance tests and grades at the U. S. Coast Guard Academy by French, Tucker, Newman, and Bobbitt (62) indicated that the factors that are most efficient in predicting scholastic success at the Academy are mathematical ability, verbal ability, reading and spatial ability in that order. The curriculum places a heavy emphasis on engineering subjects. The authors present evidence on the degree of selection existing in the final group on which the factor analysis was based. Although test-criterion correlations are available only for those admitted, some estimate of the drop in validity that occurred can be gained from the intertest correlations obtained at different phases of the selection process. For the initial group of 2,253 applicants, a very select group in itself, the median intertest correlation was .57. In the final group of 100, it was .22. One value dropped from .39 to —.22, another from .50 to .12. There was a marked increase in negative values as the group became more homogeneous. The average scores increased and the standard deviations decreased as the group was narrowed down, with these effects being most pronounced on the verbal tests. It was found that the SAT-Verbal correlated in the thirties with courses in English and history, but

had practically no predictive value for courses in physics, mathematics, engineering drawing, and signals. For some reason, the SAT-Mathematical was nearly as good a predictor for the course in English composition as the SAT-Verbal; in the other courses, it was much better, except for history and literature, subjects for which it was, as expected, quite low. It seems evident that selection on verbal ability (as it influenced high school grades, recommendations, and entrance test performance) was sufficiently pronounced in this case to eradicate much of the predictive value of verbal ability.

Davis (49) reviewed a number of studies made during World War II that attempted to predict performance in various technical schools set up by the Air Force. He concludes that in most cases highly specialized tests of rather circumscribed achievement areas proved to be the best predictors. This would, of course, be expected. The increase in predictive value, however, that such tests offer over those of *general intelligence* seems to be a function largely of the initial homogeneity of the group. In Airplane Mechanics School, where selection on verbal skills might be expected to be somewhat less than for college applicants, the AGCT correlated .41 with grade average; the best of nine special predictors correlated .54 with grades. In advanced pilot training, where a variety of educational and other hurdles of a highly verbal nature had to be overcome before an individual would even be considered as an applicant, the AGCT correlated .31 and the quite specialized Pilot Stanine .66 with grades. Apparently, to the extent verbal ability (or its correlate prior education) acts as an initial selector, it can not have as high a predictive value for course grades as tests of the other abilities and achievements inherent in the course material.

Initial selection on such factors as educational level and prior grades does reduce validity, but it is impossible to estimate the extent of the reduction that occurs *prior* to the application process. Some evidence is available, however, on the effects of selection among *applicants*. For instance, Davis reports validity coefficients computed for a sample of 1,036 aviation cadet applicants and for the 136 who were selected for admission to advanced pilot training. "Pass-fail" in advanced pilot training was used as a criterion. Arithmetic Reasoning dropped from .27 to .18; Complex Coordination from .40 to —.03; Finger Dexterity from .18

to .00; Instrument Comprehension from .45 to .27; General Information from .46 to .20; and Mechanical Principles dropped from .44 to .03.

The Prediction of Occupational Success

In this country there has been a tendency to assume that occupational placement is essentially a matter of trying to find a match between an individual's aptitude profile and some specific job. Many other factors, such as interest and personality constellation, have been taken into account but, in so far as the intellectual factors in vocational placement are concerned, the dominant theory has been that of multiple abilities. Such a position was assumed by Patterson, Gerken and Hahn (129) when they asked a number of judges to rate a variety of jobs on the degree to which academic, mechanical, social, clerical, musical, artistic, and physical abilities were required. Academic ability is apparently similar to *general intelligence;* the other abilities, except the physical, seem to have both intellectual or reasoning components and, in addition, certain motor or personality factors. Such a set of job patterns would appear to be valuable in vocational guidance and personnel work.

Lorge and Blau (110), however, have raised certain questions which go to the heart of the problem of the relationship between intellectual abilities and occupational requirements. They found that the Academic Ability scale of the Minnesota Occupational Rating Scales correlated with the Barr Scale (161), an earlier measure of occupation-intelligence demands, .92, and with the Fryer Scale (63), based on actual occupational averages of World War I soldiers, .78. The correlations between the Minnesota abilities themselves, however, were quite low. The studies were based on the original version of the Minnesota Scales (19) which did not include the more recent clerical and physical measures. Furthermore, the Minnesota abilities are in no sense defined as purely intellectual. Nevertheless, for the occupations that the Minnesota Scales have in common with the Barr Scale, the highest correlation between abilities is .45 and the median —.06. For the occupations found in the Minnesota and the Fryer Scale, the highest value is .31 and the median —.105. For the majority of abilities a negative correlation is suggested. Lorge and Blau conclude that the following statements, which are based on pooled judgments of a group of vocational psychologists, are highly improbable: A

high level of academic or abstract intelligence is frequently associated with low social intelligence; artistic ability contraindicates abstract intelligence in many cases; mechanical ability and *general intelligence* are essentially unrelated. Certainly the data presented in the first chapter on the intercorrelation of abilities and on the existence of a general factor do suggest a low validity.

Dailey (48) suggests that one of the primary advantages of the job pattern approach to occupational placement is the fact that with more dimensions a greater number of people can be considered as possesing high level talent and become available to fill top positions. The assumption is that abilities are essentially uncorrelated, and that the jobs either are or can be made into what may be termed "one-ability jobs." Dailey speaks of abilities in terms of intellectual, motor, interest, and personality variables. Thorndike (171) in discussing this viewpoint notes that intellectual abilities are rather highly correlated in the population. He also suggests that most jobs, especially at the upper levels, require multiple abilities; if all of these become the criterion, the number of people available will be much smaller than as if only a single dimension, such as *general intelligence* were the criterion. He makes the further point that people with high motor ability or high interest are not going to increase the supply of high level talent, since these aspects of a person are of value in professional and managerial jobs only to the extent they are combined with appropriate intellectual abilities.

Dailey's paper, which was presented at a symposium, produced during the discussion several other points which suggest that job revision along the "one ability" line is of dubious value. Crissy (45) feels that such a procedure is apt to produce a group of experts who are discontented because their jobs lack variety and interest. Findley (56) points out that, as jobs become specialized, the number of people in coordinating jobs, which would require multiple abilities, might be expected to increase, thus balancing any gains. This suggestion is in line with Moore's (122) conclusion that, as our society becomes more industrialized, jobs previously carried out by craftsman with multiple skills tend to be broken up and assigned to a variety of semi-skilled workers and machines, but that, at the same time, there tends to be a demand for highly skilled workers of another kind, to set up and repair the machines as well as to plan and coordinate the production process.

One further criticism of the concept of special abilities for special jobs is that, at least with regard to the intellectual abilities, there are a number of positions, especially at the unskilled level, that do not require much reasoning. In trying to find a niche for everyone to use his special skill, we sometimes forget that many jobs, though necessary, do not require any special skill. We need janitors and construction laborers as much as we need any other occupational group. In fact, if we did succeed in finding a special niche for everyone, we would be bothered a great deal more by a lack of "talent" at the lower levels than at the upper. Something like this over-utilization of talent seems to have occurred toward the end of World War II, when it became apparent that too many soldiers were in specialized training or specialized duties and that there was a real shortage of the Army's unskilled labor, infantry privates. It was then that Ph.D.'s were assigned to infantry units as riflemen.

In view of all these factors, I believe that, in a manner comparable to educational grades, the various occupations can be placed in a series of levels along a single dimension of verbal ability and that the various other content areas become important in determining appropriate jobs within a given level. Thus, for any job it would be necessary to specify the verbal level required plus the various abilities demanded. This appears to be roughly the type of occupational structure we do have today and is probably the most workable for our society. Tests of numerical, spatial, and mechanical abilities would be good predictors of success at specific jobs within verbal levels, but not nearly as good in an unselected group. Similarly, tests of verbal ability, such as vocabulary, would be good predictors of occupational level, but less good predictors of success in a specific occupation within that level, unless the occupations were primarily verbal. Such a relationship between intelligence and occupation is consistent with the fact that higher level occupations require more education and thus a more highly developed verbal skill, while lower level occupations seem to demand neither a sizable education nor the verbal skill required for such an education today. This theory does not contraindicate the profile approach in vocational guidance, but it does suggest a method of evaluating profiles that is somewhat different from the approach frequently employed in this country.

Evidence on Occupational Prediction

There is a good deal of evidence that suggests that occupations do in fact have lower bounds on a scale of verbal ability or its correlate *general intelligence.* In a study (120) designed primarily to investigate personality differences between college professors and top-level business executives, the lowest score on a 20-item vocabulary test among the 41 professors was 15, a score that is equalled or exceeded by only 17.4 per cent of the employed population. Among the 39 executives the lowest number of words correct was 14, a score equalled or exceeded by about 26.0 per cent of the employed workers in the United States. Similarly, Foulds and Raven (58) found that, when the employees of a photographic manufacturing plant were divided into five skill levels, and scores on a vocabulary test were divided into quartiles, the range of scores was much less in the top occupations than in the lower ones. Among the directors and executives, none fell in the bottom quartile and only six per cent in the third quartile. Of the highly skilled workers, 9 per cent were in the fourth quartile and 22 per cent in the third. The skilled group was fairly evenly distributed through all quartiles with, however, only 17 per cent at the lowest level. Both the semi-skilled and unskilled groups had the largest number in the fourth quartile, 34 per cent and 47 percent, respectively. The results to be presented in later chapters further support the conclusion that, when occupations are sorted into rather homogeneous groups in terms of intellectual demand, the vocabulary scores of any particular group does not cover the whole range of the test, but rather the higher the occupational level the higher the minimum demand on vocabulary.

Similar evidence comes from Wolfle's (199) study of the intelligence score distributions of college graduates with different major fields. If these values are taken as representative of persons holding jobs in these fields, and Wolfle suggests they can be, then they seem to provide substantiation of the hypothesis, even within a very homogeneous group. Not only do the median values on an AGCT scale differ in various subject groups, but there are distinct differences in the position of the 10th percentile point. The physical sciences, chemistry, engineering, and law have values above 110 while home economics and physical education have values well below 100.

Stewart (153) found in her analysis of the AGCT scores of a large sample of white enlisted men that higher civilian occupations tended to require a certain minimum of ability for entrance, but found no evidence for a ceiling on the lower occupations. Accountants had a 10th percentile value of 117; radio repairmen, 97; light truck drivers, 69; and farm laborers, 60. These values can not be considered definitive for the population as a whole, because the Army group did not contain officers, women, or Negroes, and the older age group was underrepresented. Nevertheless, the existence of lower bounds for various occupations would presumably be substantiated with a more representative sample, even if the actual values were to shift. Stewart did, in fact, find the same phenomenon in a study (154), which included Negroes, of the relationship between AGCT score and military occupational specialty. For weather observers the 10th percentile score was 114; for radar mechanics, 105; for aircraft welders, 87; and for heavy artillery gun crewmen, 68.

Anderson Brown, and Bowman (5) analyzed the Harrell and Harrell (79) data on white enlisted men of the Army Air Force Service Command. They, too, found a tendency toward the establishment of lower bounds when they grouped the occupations, using a system similar to that employed by the Census Bureau. This grouping is only incidentally based on skill and, therefore, does not ensure any marked degree of homogeneity in terms of intelligence within each level. Nevertheless, one per cent of the professional and managerial workers, two per cent of the clerical, nine per cent of the skilled, 17 per cent of the semi-skilled, and 22 per cent of the unskilled have AGCT scores below 80.

As to the prediction of job success, a large part of the evidence comes from the experience of British psychologists during World War II. Vernon (184, 186) reports that the best basis for determining who would do well on a job was past experience on practically identical jobs, but that, barring this, a kind of general intelligence with a strong verbal-educational emphasis was most important. If, for instance, a recruit failed at a job, it was almost invariably true that shifting him to another position at the same level was useless, even though he claimed interest or prior experience in the new area. The correct solution in such cases was, much more frequently, to place the recruit in a lower level position. Vernon's conclusion is that the important factor in occupa-

tional prediction is the single continuum along which various jobs can be ranked rather than the number of abilities required by the job. In another publication, Vernon (185) elaborates on this position by pointing out that the best predictor for officers, noncommissioned officers, parachutists, and specialists of all kinds was a test of "g," such as the ordinary verbal group tests or the Stanford-Binet.

Similar conclusions were reached by Halliday (75) who found that in selecting skilled craftsmen he was much more successful if he took those applicants who had the highest mechanical ability among those with relatively low, but not the lowest, intelligence. The mechanical ability of these individuals might not be high on an absolute scale, but, if it was highly developed relative to other abilities, the individual tended to do well on the job. The main reason for not selecting individuals at a higher general ability level, whose performance tended to be superior, was that they did not stay craftsmen but moved rapidly to higher level jobs in their own or other companies. The best method of selection seemed to be the use of tests of mechanical ability within a certain range of scores on an intelligence test.

Another study, of interest here, was carried out by Lingwood (103) using material gathered during the testing of women recruits in the British Armed Services. A variety of special ability tests of content areas, such as spelling, arithmetic, spatial, and mechanical, were employed, and their results grouped on the basis of civilian occupations. The occupational means fell in essentially the same order on all tests, but special abilities that were particularly relevant to the job were apt to be at the highest level. For instance, shorthand-typists ranked from first through fourth out of 17 occupational groups on all tests and were highest on Spelling. Dressmakers obtained their highest rank, fifth, on the Spatial Test; their lowest rank on any test was tenth. Laundry hands ranked fourteenth through seventeenth on all tests, doing best on the Mechanical Comprehension Test. These findings were based on a heterogeneous sample covering nearly the whole range in the population. Lingwood describes the results as being in agreement with the hypothesis that occupational success requires a general ability of a largely verbal-educational nature and, beside this, certain abilities which are directly relevant to the job.

Although this concept of occupation-intelligence relationships

has in the past been associated most frequently with the British psychologists, especially Burt (28) and Vernon, a number of studies carried out in this country seem to substantiate it. Probably the most striking of these is the long-range study of gifted children, by Terman and his co-workers. The children, with I.Q.'s of 135 and above, were originally selected while in school on the basis of the 1916 Stanford-Binet and a group mental test. They were followed up periodically. As of 1944, 48.3 per cent of the civilian men were in the professions, 32.0 per cent in semi-professional and higher business positions, 15.7 per cent in skilled trades, white collar jobs or retail business, 2.2 per cent were farmers, and 1.9 per cent were semi-skilled. As Terman (163) has pointed out, these results suggest that tests of general intelligence, with their highly verbal content, are very good predictors of subsequent occupational level, although they indicate nothing about the special field that the individual should or will enter. The fact seems to be that individuals who possess a highly developed verbal skill will succeed in attaining a relatively high occupational level, unless personality factors or those associated with social group membership interfere. This achievement is not always in the highly verbal occupations, but may be in the physical sciences, engineering, or other fields that require skills that were not tapped in the original testing.

A study that offers some information on the value of content areas other than the verbal for the prediction of job success was carried out by Barnette (13, 14) using data on counseled veterans. Follow-up questionnaires were employed to determine the relationship between the pattern of aptitude test scores, obtained in the initial testing, and the subsequent occupational histories. If it was found that an individual was going ahead as counseled, he was considered a member of the success group. If he did not go ahead or if he had shifted to some other job or type of training, he was placed in the failure group. The test profiles of these two groups were then compared for a number of job areas to determine what factors differentiated the success and failure groups. Failure to follow the recommendations of the counselor should, of course, not be equated with occupational failure in general. Many may in fact have been working successfully in other areas. In the group to whom engineering was recommended, both the successes and failures were well above the population mean on practically

all tests. On the ACE, a group test of verbal and quantitative ability, they were both extremely high. The success group, however, did better than the failures on tests of chemistry, engineering, and physical science aptitude. In a group who were counseled to seek jobs as salesmen, the successful, most of whom were in retail selling, did somewhat better on tests of mechanical and quantitative ability; but again the characteristic factor was a tendency in both groups for their mean scores on all tests to cluster at the same level, in this case the population mean. The clerical group was divided into two sections, a general clerical group including those, such as file and mail clerks, whose jobs would require no special skill, and special clerical workers, such as typists and stenographers. The former were generally below the population average on all tests in both the success and failure groups. The special clerical workers tended to perform at or somewhat above the population norm on practically all tests; the successful ones had somewhat higher scores on tests of clerical aptitude and on the ACE, especially the Verbal Section. For those to whom accounting was recommended, no differences appear between the success and failure groups, both groups being consistently above the rest of the population. Scores on tests of mathematical ability, including the ACE Quantitative Section, tended to be quite high; but the ACE Verbal Section was also at a high level.

The characteristic feature for all or most of the tests applied is the tendency of the scores to cluster at the same level within an occupational group. The ACE Verbal Section follows the other tests in this respect. That is, engineers and accountants, who might be expected to need special mechanical and numerical abilities primarily, do quite well also on tests of verbal ability, while salesmen whose jobs require a somewhat lower level of intelligence, although primarily verbal in nature, do perform less well on the ACE Verbal Section. The tests of abilities other than the verbal seem to differentiate most successfully with the engineers, salesmen, and special clerical workers.

The literature, both British and American, that has been reviewed, is in general quite consistent with a position on the relationship between occupation and intelligence that posits a primary verbal continuum as a predictor of occupational level. The development of tests to measure other abilities is still in

progress, and the relationships between these content areas and specific jobs has only begun to be defined. There is no doubt that factor analysis can be a valuable tool in this process, especially in attempting to ascertain what are meaningful content areas and what types of tests might most appropriately be used to tap these abilities. The value of tests of group factors, other than the verbal in predicting occupational success has not yet been conclusively demonstrated, although the studies of Halliday and Barnette point to the importance of some non-verbal abilities, established by other than factorial methods, in occupational prediction.

CHAPTER 3

THE SURVEY*

Although the considerations outlined in the introductory chapters were of primary importance in the selection of an appropriate test for this study, the final decision was made only after an intensive search of the literature. The survey of the various short-form intelligence tests that have been developed lead finally to the selection of Form A of a twenty-word, multiple-choice, vocabularly test which Thorndike (169) had adapted from the longer vocabulary section of the Institute of Educational Research Intelligence Scale, CAVD. Two words from each of the ten levels of the CAVD vocabulary are included in the short test, and five alternative answers are offered for each word. The test is given without time limit. Form A was selected for use because of Thorndike's conclusion, based on the original standardization data, that it is slightly easier at the lower levels and harder at the higher levels. The test has been standardized by administering it along with the Otis Self-Administering Intelligence Examination, Intermediate Level, Form A, to 538 students in the seventh through ninth grades and the Higher Level, Form A to 456 students in the tenth and eleventh grades. Otis Mental Age equivalents, for the scores with a large enough number of cases to warrant the computation, are presented in Table III along with percentile equiva-

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TABLE III OTIS M. A. AND ACE PERCENTILE EQUIVALENTS OF VOCABULARY SCORES

Vocabulary Score	Otis M.A. Equivalent	ACE Percentile Equivalent
17		99
16		96
15		86
14		73
13	17-6	56
12	17-2	42
11	16-8	21
10	16-1	
9	15-2	
8	13-8	
7	12-0	
6	10-5	

Reproduced with the permission of the American Psychological Corporation from Thorndike (169).

lents obtained from the administration of the vocabulary test and the American Council Psychological Examination to 268 entering college freshmen. These latter equivalents are derived from the ACE Verbal Section only.

One of the reasons for selecting this particular measure was that it had previously been found suitable for use by door-to-door interviewers. Thorndike and Gallup (172) included it in a regular weekly survey of the American Institute of Public Opinion. The sample used was a voting sample and thus excluded those under twenty-one, Negroes in some Southern states, aliens, those not registered to vote, and migratory workers. The test was given in the middle of the interview and was introduced as containing some words that were being tried out to see if they were suitable for use on a quiz program. More recently, Thorndike and Hagen (173) have employed the test in a series of field trials, carried out to study the feasibility of an aptitude census. Males 18 years and older were tested on a door-to-door basis in Centre County, Pennsylvania; New York, New York; Springfield, Massachusetts; Fort Wayne, Indiana; Greenwood, South Carolina; Lancaster, Pennsylvania; and Portland, Maine. The sample is described as containing not enough persons living west of the Mississippi and in rural areas, and as not adequately representing the lower educational levels.

Thorndike reported several reliability coefficients for the test. From the standardization data (169) he estimated that parallel form reliability would be .83 for a cross-section adult group. In another place (172) he estimates a figure between .80 and .85. A value of .85 was obtained by employing the odd-even, split-half method with the data from the first four areas mentioned above in connection with the Thorndike and Hagen study (74, 173). The usual Spearman-Brown correction for test length was applied. In 1948 Thorndike (170) estimated the parallel form reliability for a cross-section of adults at .915 using all the test results he had available at that time.

The Selection of the Sample

The sample was collected by the interviewers of Public Opinion Surveys, Inc., of Princeton, New Jersey, using a sample design similar to that employed in national surveys conducted by that organization. The design provides stratification by seven regions (groups of states), and within each region stratification by geographical distribution of the population, three urban-rural strata, United States Census economic areas, and size of locality. A systematic sample of localities was drawn within each stratum from a random start with probability of selection proportional to size. Within large urban communities, sampling units (small clusters of blocks) were drawn at random with probability proportional to size. In smaller communities and rural regions, sampling areas were drawn with equal probability. Interviewers were assigned selected areas or clusters of blocks and were required to work within the boundaries of such areas, where they chose respondents on the basis of quota assignments by sex and age. This phase of the project was carried out during the months of August and September, 1953.

When the total 1,500 interviews had been returned, the answers to cross-section questions were checked against the latest available Census data and the sample compared with population figures. The distribution of respondents was found to be inadequate in certain categories, and accordingly a supplementary sample design was set up employing a quota system for the selection of respondents on the basis of sex, education, and more specific age categories instead of the original area sampling with quota control. The prior stratification in terms of geographical, urban-rural,

and economic areas as well as size of locality was continued. Quotas were assigned in such a way as to fill out deficiencies in the original sampling. The discarding of the area sampling procedure was necessitated by the specificity required in selecting respondents falling in certain very narrow educational and age groupings. Interviewing on this phase was conducted during December, 1953, and January, 1954. In all, 1,896 completed protocols were obtained from which a representative sample of 1,500 cases was selected. The survey included 329 sampling areas in 228 localities (cities, towns, and counties). In each sampling area from five to seven interviews were assigned.

The population from which the sample was drawn includes individuals over nine years of age living in the continental United States of America except inmates of institutions and members of the Armed Services living on post. Also excluded were those who were completely unable to speak English or who were obviously handicapped in their use of English by a lack of exposure to it, and who, nevertheless, spoke some other language fluently.

The Interview

The standard interview consisted of the administration of the Tomkins-Horn Picture Arrangement Test, the vocabulary test, and a number of background questions, in that order. The time required to complete the interview varied from 45 minutes to 2½ hours per respondent. The interviewer introduced himself as follows:

> I'm an interviewer for the Gallup Poll. We're making a nationwide survey for a group of leading psychologists on a picture-arrangement experiment. Is there a table inside where we can go over this together?

After being seated, the interviewer administered the Tomkins-Horn Picture Arrangement Test and then introduced the vocabulary test as follows:

> We're trying to find out how familiar these words are to people. Will you please look at this card and give me the number of the word that seems closest to each word in capital letters.

Next a card was handed to the respondent on which was written the following instructions:

> Please look first at the word in capital letters on each line. Then look at the other words in smaller type on the same line and tell me which ONE of these words comes closest in meaning to the one in capital letters.

EXAMPLE

BEAST 1. afraid 2. words 3. large 4. animal 5. bird

The correct answer in this example is number 4, since the word "animal" comes closer to "beast" than any of the other words.

IMPORTANT: Do only one line at a time, and please take each line in order. Call off the word you are referring to first, and then the number of the word on the same line you think comes closest to it.

The test followed (see Fig. 1), and the interviewers recorded the answers on an answer sheet (Fig. 3).

The special instructions to the interviewers were designed to cover points which might arise during the administration of the vocabulary test. They read as follows:

If the respondent is obviously having difficulty in reading the instructions and words on the card, or he cannot read at all, it may be necessary to administer the test orally. In such a case, read the instructions aloud, and then go through the test. Read the "key word" first; then pause momentarily before reading the five possible answers. Check the number of the word chosen as closest in meaning to the key word and circle that number on the answer sheet.

If the respondent reads the words to himself he should tell you simply the number of the word he selected as closest in meaning to the key word. *Then you should circle that number on the answer sheet.*

Keep the following specific points in mind in handling this part of the interview:

1. If the respondent is hesitant about giving his answers, you might mention that these words are difficult for almost everyone and certainly very few people get them all right.

2. In some cases, the respondent may ask if he is right immediately after giving an answer. Since knowledge of how he is doing may influence his performance on the remainder of the words, delay giving the correct answers until the interview has been completed.

3. Be sure the respondent tries all 20 words on the test. Encourage him to guess if he is not sure. Guessing is preferable to leaving blanks.

The interview was terminated with the administration of the cross-section questions as indicated in Fig. 2. The interviewer's bulletin contained the following cautions:

The cross-section questions are, in general, those with which you are familiar. They are printed on the last page of the answer sheets and should be asked at the end of the interview. *Do not forget to ask these questions!* They are needed for interpretation of the answers you obtain to the rest of the interview. None of them can be omitted.

Also, be careful to fill in the information needed at the bottom of the page as to whether the respondent lives in a city or town over 2,500 population, in country or town under 2,500 population (non-farm property), or on farm property.

						Correct Answers
A						
SPACE	1. school	2. noon	3. captain	4. room	5. board	4
LIFT	1. sort out	2. raise	3. value	4. enjoy	5. fancy	2
CONCERN	1. see clearly	2. engage	3. furnish	4. disturb	5. have to do with	5
BROADEN	1. efface	2. make level	3. elapse	4. embroider	5. widen	5
BLUNT	1. dull	2. drowsy	3. deaf	4. doubtful	5. ugly	1
B						
ACCUSTOM	1. disappoint	2. customary	3. encounter	4. get used	5. business	4
CHIRRUP	1. aspen	2. joyful	3. capsize	4. chirp	5. incite	4
EDIBLE	1. auspicious	2. eligible	3. fit to eat	4. sagacious	5. able to speak	3
PACT	1. puissance	2. remonstrance	3. agreement	4. skillet	5. pressure	3
SOLICITOR	1. lawyer	2. chieftain	3. watchman	4. maggot	5. constable	1
C						
ALLUSION	1. aria	2. illusion	3. eulogy	4. dream	5. reference	5
CAPRICE	1. value	2. a star	3. grimace	4. whim	5. inducement	4
ANIMOSITY	1. hatred	2. animation	3. disobedience	4. diversity	5. friendship	1
EMANATE	1. populate	2. free	3. prominent	4. rival	5. come	5
MADRIGAL	1. song	2. mountebank	3. lunatic	4. ribald	5. sycophant	1
D						
CLOISTERED	1. miniature	2. bunched	3. arched	4. malady	5. secluded	5
ENCOMIUM	1. repetition	2. friend	3. panegyric	4. abrasion	5. expulsion	3
PRISTINE	1. flashing	2. earlier	3. primeval	4. bound	5. green	3
TACTILITY	1. tangibility	2. grace	3. subtlety	4. extensibility	5. manageableness	1
SEDULOUS	1. muddied	2. sluggish	3. stupid	4. assiduous	5. corrupting	4

No. ______________

Fig. 1 The Vocabulary Test

Now, here are a few questions so that my office can keep track of the cross-section I'm getting:

1. What was the last grade or class you completed in school?
   1( ) No schooling
   2( ) Grammar School (Grades 1 through 6)
   3( ) Grammar School (7th or 8th grade)
   4( ) High School, Incomplete (9th, 10th or 11th grades)
   5( ) High School, Graduate (12th grade)
   6( ) College, Incomplete   Record Full Name of College Below
   7( ) College, Graduate   . . . .

---

2. a. What is your job or occupation? . . . .
   b. What kind of work does the HEAD OF YOUR IMMEDIATE FAMILY do? . . . . .
   . . . .
   IF RETIRED OR UNEMPLOYED, ask:
   c. What did he/she/you do? Write in above.

---

3. Are you married, single, widowed or divorced?
   1( ) Married   2( ) Single   3( ) Widowed   4( ) Divorce

---

4. What is your religious preference — Protestant, Catholic or Jewish?
   1( ) Protestant   2( ) Catholic   3( ) Jewish
   4( ) Other. . . . .

---

5. If you were asked to use one of these four names for your social class, which would you say you belong in — the middle-class, lower-class, working-class, or upper-class?
   1( ) Middle-class   2( ) Lower-class   3( ) Working-class   4( ) Upper-clas

---

6. And what is your age? . . . .

---

7. Check whether: 1( ) White   2( ) Colored
   1( ) Man   2( ) Woman

PLEASE COMPLETE ALL VITAL INFORMATION BEFORE LEAVING RESPONDEN

RESPONDENT LIVES:

1( ) In city or town over 2,500 pop.   2( ) In country or town under 2,500 pop. (Non-Farm Property)   3( ) On farm property

---

STREET. . . . . CITY & STATE . . . .
Address of Respondent – Street & Number

I hereby attest that this is a true and honest interview:

. . . . DATE OF INTERVIEW. . . . . Code #______
Interviewer's Signature

Fig. 2 Cross-Section Questions

KEY WORD	(Circle Number Given By Respondent For Each Word)				
A					
SPACE	1.	2.	3.	4.	5.
LIFT	1.	2.	3.	4.	5.
CONCERN	1.	2.	3.	4.	5.
BROADEN	1.	2.	3.	4.	5.
BLUNT	1.	2.	3.	4.	5.
B					
ACCUSTOM	1.	2.	3.	4.	5.
CHIRRUP	1.	2.	3.	4.	5.
EDIBLE	1.	2.	3.	4.	5.
PACT	1.	2.	3.	4.	5.
SOLICITOR	1.	2.	3.	4.	5.
C					
ALLUSION	1.	2.	3.	4.	5.
CAPRICE	1.	2.	3.	4.	5.
ANIMOSITY	1.	2.	3.	4.	5.
EMANATE	1.	2.	3.	4.	5.
MADRIGAL	1.	2.	3.	4.	5.
D					
CLOISTERED	1.	2.	3.	4.	5.
ENCOMIUM	1.	2.	3.	4.	5.
PRISTINE	1.	2.	3.	4.	5.
TACTILITY	1.	2.	3.	4.	5.
SEDULOUS	1.	2.	3.	4.	5.

Code #__________

Fig. 3 Answer Sheet—Vocabulary Quiz

Adequacy of the Sample

Data from the Current Population Reports issued by the Bureau of the Census were used in setting up expected frequencies for analysis of each of nine background variables, as indicated in Table IV. In each case the Census data employed were those for the date most nearly coinciding with the interviewing period. Using IBM sorting procedures, a sample of 1,500 was drawn from the total of 1,896 cases. Since, as will become evident later, it was important that the sample represent, with a high degree of precision, the educational level of students and the occupational grouping of the employed as well as the number of employed workers and students, perfect matching with the Census data was

TABLE IV SAMPLE COMPARED WITH POPULATION DATA

Background Variables	Sample N	Sample Percentages	Population Percentages
Education of Students (Grades completed)			
8 or less	154	61.4	61.4
9 - 12	74	29.5	29.5
13 or more	23	9.2	9.2
Education of Non-students (Grades completed)			
0	28	2.2	2.1
1 - 6	203	16.3	39.6
7 - 8	290	23.2	
9 - 11	235	18.8	18.7
12	323	25.9	26.1
13 - 15	86	6.9	6.9
16 or more	84	6.7	6.6
Sex			
Male	721	48.1	47.9
Female	778	51.9	52.1
Unknown	1	.1	
Race			
White	1347	89.8	89.9
Negro	153	10.2	10.1
Age			
10 - 13	124	8.3	8.2
14 - 17	110	7.3	7.2
18 - 24	157	10.5	10.4
25 - 34	283	18.9	19.1
35 - 44	270	18.0	18.0
45 - 54	219	14.6	14.8
55 - 64	175	11.7	11.5
65 - 74	118	7.9	10.8
75+	39	2.6	
Unknown	5	.3	
Marital Status			
Married	940	62.7	63.1
Single	410	27.3	27.3
Widowed	120	8.0	7.8
Divorced	30	2.0	1.8
Religion			
Protestant	1121	74.7	No Data
Catholic	293	19.5	
Jewish	49	3.3	
Other	36	2.4	
Unknown	1	.1	

TABLE IV (Continued) SAMPLE COMPARED WITH POPULATION DATA

Background Variables	Sample N	Sample Percentages	Population Percentages
Class Identification			
Upper	47	3.1	No Data
Middle	579	38.6	
Working	790	52.7	
Lower	62	4.1	
Unknown	22	1.5	
Rural-urban Residence			
Farm	203	13.5	No Data
Under 2,500	377	25.1	
2,500 - 9,999	171	11.4	
10,000 - 49,999	209	14.0	
50,000 - 499,999	275	18.4	
500,000 and over	265	17.7	
Geographical Area			
New England	96	6.4	6.1
Middle Atlantic	341	22.7	22.7
East Central	269	17.9	18.1
West Central	169	11.3	11.3
Border South	266	17.7	18.1
Deep South	154	10.3	9.9
Rocky Mountain	52	3.5	3.5
Pacific Coast	153	10.2	10.3
Relation to Labor Force			
Employed	745	49.7	49.7
Unemployed	23	1.5	1.5
Students	251	16.7	16.7
Housewives	423	28.2	32.1
Retired	58	3.9	
Occupation—Census Classification (Employed only)			
0 Professional, technical, and kindred workers	68	9.1	9.1
1 Farmers and farm managers	45	6.0	6.0
2 Managers, officials, and proprietors, except farm	78	10.5	10.5
3 Clerical and kindred workers	102	13.7	13.7
4 Sales workers	48	6.4	6.4
5 Craftsmen, foremen, and kindred workers	102	13.7	13.7
6 Operatives and kindred workers	154	20.7	20.7
7 Service workers	81	10.9	10.9
8 and 9 Farm laborers and foremen; laborers, except mine	67	9.0	9.0
Occupation—Intelligence Classification (Employed only)			
Highly Skilled	91	12.2	No Data
Skilled	236	31.7	
Semi-skilled	286	38.4	
Unskilled	132	17.7	

carried out initially on these variables. Following this, approximate matching was attempted on sex, race, age, marital status, and geographical area. The other variables noted in Table IV, occupation classified by intelligence required, religion, and class identification, can not be compared with population figures since there are no such data available. Rural-urban residence might have been controlled on the basis of 1950 Census material. However, these figures were already quite out of date by 1953; it seemed advisable not to attempt matching, especially since, with controls on nine other variables, the probability of a sizable error seemed small. Our data suggest a slight tendency to increased urbanization since 1950, which probably reflects true population changes.

The categories employed in classifying the background characteristics of the respondents were determined according to the following specifications:

Education

Classification was based on the last grade completed. Respondents who had been trained in business, trade, or beauty schools, as well as nurses whose education was received outside of a regular academic college were considered as high school graduates. Junior college education was taken as equivalent to an incomplete college course.

Geographical

Grouping by state was carried out as follows: *New England* (Me., N.H., Vt., Mass., R.I.); *Middle Atlantic* (N.Y., N.J., Pa., Del., Md., W.Va.,); *East Central* (Ohio, Mich., Ill., Ind.); *West Central* (Wisc., Minn., Iowa, Mo., N. Dak., S. Dak., Nebr., Kans.); *Border South* (Va., N.C., Ky., Tenn., Okla., Texas, Fla., D.C.); *Deep South* (S.C., Ga., Ala., Miss., La., Ark.); *Rocky Mountain* (Mont., Ariz., Colo., Idaho, Wyo., Utah, Nev., N.M.); and *Pacific Coast* (Calif., Ore., Wash.).

Occupation—Census Classification

The Census classification was determined through the use of the Alphabetical Index of Occupations and Industries (183) prepared by the Bureau of the Census. Code numbers 8 and 9 were combined because of the small number of cases falling in the farm laborer group.

Occupation—Intelligence Classification

This method of grouping occupations was devised especially for the present study. Since the sample of 1,500 was too small to permit any valid estimate of the average intelligence in the population of various occupational groups (many occupations being represented by only one or two cases), a rather extensive search of the literature for an appropriate classification schema became necessary. A number of attempts have been made to estimate the demand of specific jobs in terms of *general intelligence.* There is also a good deal of information available from the intelligence testing programs in the Armed Services. Unfortunately, neither of these sets of data can be utilized directly for the present purposes. Both the judges' estimates and the Armed Forces material cover only a limited number of occupations. Since new occupations are continually developing and old ones disappearing, any schema is rather quickly outdated. In addition, although the Armed Forces information has the advantage of precise measurement, it is, as has been previously noted, in no sense representative of the population as a whole. The systems used in the Alphabetical Index of Occupations and Industries and in the Dictionary of Occupational Titles would be ideal in terms of their comprehensive coverage of the job structure of this country, but they are not based primarily upon skill level or intelligence demand.

Since the purpose was to group occupations in terms of different levels of intellectual demand, taking into account the essentially verbal nature of such a hierarchy and the correlation of abilities in the population, and since the sample of 1,500 cases contained many occupations that had not previously been classified in the scales of *general intelligence,* a new classification had to be carried out. Classification was restricted to occupations that actually appeared in the sample, a total of 316; four levels seemed adequate. The actual level at which each occupation was placed is indicated in the Appendix.* Classification was carried out without knowledge of the vocabulary test scores. The general nature of the kinds of work included in each occupational category is as follows:

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*I would like to express my appreciation to Professor Wilbur E. Moore of the Department of Economics and Sociology at Princeton University for his assistance in classifying the various occupations.

Level I. Highly Skilled Workers. The top 12.2 per cent of the intelligence distribution, consisting primarily of high level professional workers, executives, workers involved in the most technical and complex clerical and sales work, and large scale farmers. A total of 49 occupations.

Examples: Lawyer, bank executive, accountant, sales manager, manager of a large, specialized farm.

Level II. Skilled Workers. The upper middle 31.7 per cent of the intelligence distribution consisting primarily of most retail managers, the upper level of skilled workers, skilled clerical workers, foremen, wholesale salesmen, technicians, lower level professional workers, and relatively large-scale farmers. A total of 107 occupations.

Examples: Restaurant manager, millwright, stenographer, railroad foreman, real estate salesman, dental technologist, and undertaker.

Level III. Semi-skilled Workers. The lower middle 38.4 per cent of the intelligence distribution consisting primarily of lower level skilled workers, the semi-skilled, routine clerical workers, retail sales clerks, most farmers, and proprietors of relatively simple businesses. A total of 110 occupations.

Examples: Boilermaker, factory metal finisher, shipping clerk, house-to-house salesman, tenant farmer, and boarding house landlady.

Level IV. Unskilled Workers. The lower 17.7 per cent of the intelligence distribution consisting primarily of laborers and unskilled service workers. A total of 50 occupations.

Examples: Farm laborer, newsboy, janitor, and garbage collector.

Although none of the existing classification systems (based on judges' estimates or military data) was used, they were referred to frequently. The present schema would probably correlate rather highly with the Academic Ability Section of the Minnesota Occupational Rating Scales (129), the Taussig Scale (161), the Barr Scale, and Lorge and Blau's (109) conversion of the Barr and Fryer material to Dictionary of Occupational Titles groupings. Other material used includes the Fryer (63) data on Army Alpha scores of World War I recruits, the studies of AGCT scores of military and civilian occupational groups by Stewart (153), the Harrell and Harrell (79) material on the AGCT as related to

civilian occupations of Army Air Force personnel, the information gathered by Himmelweit and Whitfield (86) on 10,000 British Army Recruits, and Wechsler-Bellevue data presented by Simon and Levitt (144) and derived from 1,753 records gathered in the New York City area.

Religion

The only question asked was on religious preference. No attempt was made to get at church membership, attendance, etc.

Class Identification

The respondent's own opinion was accepted. He was offered a choice of the four categories and was to choose one. This procedure is identical with that employed by Centers (32) in his study of social classes.

Rural-urban Residence

The farm classification was restricted to respondents who actually lived on farm property. All others who lived in the country and those who lived in towns of under 2,500 population, as of 1950, were placed in the "Under 2,500" group. City size was determined from the 1950 census.

Statistical analysis of the deviation of the sample frequencies from those expected on the basis of data available for the total population indicates that in no case does a sample frequency differ significantly from the population value. Although the sample does not contain exactly the same people as were used in the standardization of the Tomkins-Horn Picture Arrangement Test (180), the two samples are very similar. The major change occurred in obtaining a perfect matching with the Census data on student education and occupational groupings. In a few cases, slight changes were made in the population percentages as a result of the recent issuance of presumably more appropriate information by the Bureau of the Census.

Test Scores

As is indicated in the instructions given to the interviewers, respondents were urged to guess if they did not know a word. Although every effort was made to get them to try every word, some refused to do so. If a test was not completed, a correction

for not guessing was added to the total score according to the number of words skipped. Utilizing a chance expectancy, we added nothing if two or less words were left out, one for three through seven, two for eight through twelve, three for thirteen through seventeen, and four for eighteen or more. In 92.7 per cent of the records, no correction of any kind was necessary; and of those that were corrected, by far the majority had one point added to their score.

A person who does not know any of the words might be expected to guess four correctly. Five alternatives are offered, and one item out of five might be answered correctly by chance alone. Actually a person with no knowledge may do somewhat worse or better than the chance score of "four," depending on whether he is lucky or not. In our sample the lowest score actually obtained was "two." Since the subject was urged to guess, the Mental Age and college percentile norms provided by Thorndike are apt to deviate somewhat, and the present results are not directly comparable.

The decision to urge respondents to guess was made primarily because some people will guess even when told that they will be penalized for it, and these guessers will, in almost all cases, get a higher score than those of equal ability who do not guess. Other people may hesitate to give a correct response because they are not quite sure. Urging them to guess gives them credit for words they really know but might not have volunteered.

These conclusions are consistent with the results obtained by Swineford and Miller (159) who gave a 100-item vocabulary test containing ten nonsense words and ten extremely difficult words to three groups of subjects. Group I had no instruction as regards guessing; group II was told there would be a penalty for guessing (right minus wrong); and group III was told to guess. Both groups I and III tried an average of more than nine of each set of ten bogus items, although those told to guess attempted reliably more; 80 per cent of both these groups tried all twenty "impossible" items. Group II, in spite of being told not to guess, still tried an average of 5.5 out of each set of ten words; 40 per cent tried all twenty words, and 40 per cent tried no more than five of the special words. The correlation between ability, as measured by the 80 valid items, and tendency to guess was very low in all groups, but reached a value significantly different from zero (.16) in group II.

One further point needs clarification. I have used the raw scores obtained by the respondents in all comparisons. No attempt has been made to compute I.Q.'s or any other modified score that would correct for differences in age. Although such corrected scores may have value in specific situations, they seem in general to deal with an abstraction from the society as a whole and, thus, lose the predictive power of raw scores. An I.Q. may indicate how an individual can perform relative to his age mates, but it does not tell us how he can perform relative to all other members of the society. As Bingham (20) has pointed out, if a man is being considered for a job, the crucial factor is his ability relative to all other applicants, whatever their age. If older people decline in intelligence or (having had less education as a group) have always performed at a level below those 30 years younger (who as a group obtained more education), this is important information that should not be obliterated by setting a score of 100 as the average for every age group.

CHAPTER 4

SOCIAL STRATIFICATION: THE MAJOR FACTOR IN INTELLIGENCE DIFFERENCES

This chapter and the one following present the results of the study in so far as the relationships between the vocabulary test scores and background variables are concerned. The most striking result is that the major differences in mean scores appear on the variables that are related to social stratification, namely, education, occupation, race, and subjective class identification. Although the other variables, sex, age, rural-urban residence, geographical area, and religion, may produce reliable differences, these are fewer in number and of a much smaller order when they do occur. This chapter deals with the first group, the major factors in intelligence differences, while Chapter V considers the minor factors.

In computing the reliability of the differences between means, Student's "t" based on a pooled sum of squares has been used. In some cases, however, there were significant differences between the standard deviations of the two groups being compared; thus the assumption of homogeneity of variance was not met. Under these circumstances, the differences were tested in two separate ways. One procedure was to split the total distribution at a point nearest to the median and then, by dividing the distribution into its original component groups, obtain a fourfold table suitable for the computation of chi-square with one degree of freedom. Thus, by employing a non-parametric technique, it was possible to proceed without meeting the homogeneity of variance requirement. Secondly, following Edwards (53), "t" was obtained by computing the variance of each mean separately rather than by

pooling the sum of squares. Thus, the assumption that both samples are drawn from a common population is not made, since it is known that they are drawn from populations with different variances. These latter values are entered in the tables of "t" values where appropriate. In all cases a two-tailed test of significance has been employed, and values based on rather small samples have been designated by placing them in parentheses. P values have been indicated as follows: above .10 by > .10, below .10 but above .05 by < .10, below .05 but above .02 by < .05, below .02 but above .01 by < .02, below .01 but above .001 by < .01, and below .001 by < .001.

EDUCATION

The results obtained for different educational groups are given in Tables V and VI. The students show highly reliable and rather marked differences between educational levels. (Among those who are no longer in school (Table VI), there is a consistent rise in average intelligence with an increase in amount of schooling.) This rise is comparable to that of those still in school and suggests that education as a primary factor in actual exposure is more important in determining the level to which intelligence is developed than any direct effect of age.)

(The only difference which does not reach a high level of significance is that between those who left college after, at least, one

TABLE V INTELLIGENCE OF STUDENTS

Years Completed	Mean	Standard Deviation	N
8 or less	8.84	2.93	154
9 - 12	10.68	2.55	74
13 or more	(13.74)	(2.66)	23

t Values

	9 - 12	13 or more
8 or less	4.61	8.13
9 - 12		4.87

P Values

	9 - 12	13 or more
8 or less	<.001	<.001
9 - 12		<.001

Values based on rather small samples have been designated by placing them in parentheses.

TABLE VI INTELLIGENCE OF EDUCATIONAL GROUPS (NON-STUDENTS)

Years Completed	Mean	Standard Deviation	N
0	(6.96)	(2.65)	28
1 - 6	8.41	3.06	203
7 - 8	9.80	3.04	290
9 - 11	10.77	2.60	235
12	12.25	2.94	323
13 - 15	13.97	2.94	86
16 or more	14.73	2.76	84

t Values

	1 - 6	7 - 8	9 - 11	12	13 - 15	16 or more
0	2.38	4.76	7.28	9.18	11.13	12.92
1 - 6		4.96	8.58[1]	14.22	14.26	16.33
7 - 8			3.93[2]	10.12	11.24	13.22
9 - 11				6.15	9.40	11.75
12					4.81	6.96
13 - 15						1.73

P Values

	1 - 6	7 - 8	9 - 11	12	13 - 15	16 or more
0	<.02	<.001	<.001	<.001	<.001	<.001
1 - 6		<.001	<.001	<.001	<.001	<.001
7 - 8			<.001	<.001	<.001	<.001
9 - 11				<.001	<.001	<.001
12					<.001	<.001
13 - 15						<.10

[1] Variances significantly different. $\chi^2 = 48.20$ $P < .001$
[2] Variances significantly different. $\chi^2 = 13.18$ $P < .001$

year but before graduation and those who graduated. If those who left college during their first year had been included in the college incomplete group, it seems quite probable that a highly reliable difference would have been obtained, because most failures due to inadequate intellectual ability occur during the first year. White (195) found that in the Cleveland-Akron-Lorain area of Ohio the average I.Q. of secondary school graduates going to college was 115.5, and the average for drop-outs during the first year was 111.0. The difference between these values was significant. Although, with samples larger than those of the present study, or using a one-tailed test of significance, the difference presumably would reach significance, it does seem probable that leaving college after the first year is less a function of intelligence than of other factors.

The existence of a lower standard deviation for adults with nine through eleven years of education than for the grade school groups does not seem to have any effect on the mean differences involved, since the corrected "t's" and chi-squares are still highly significant. Just why this particular drop in variance occurs is open to speculation. It may be a function of sampling fluctuations.

A number of other studies have reported an equally high relationship between intelligence and education. Yerkes (202) obtained correlation coefficients varying from .53 to .75 from various samples of World War I Army recruits using the Army Alpha. Similar values have been reported for World War II soldiers on the basis of the AGCT. In a sample of 4,330, the Personnel Research Section of the Adjutant General's Office (152) obtained a value of .73. Tuddenham (182) reports a figure of .70 and Duncan (51) a contingency coefficient of .54 when the highest possible value was .894.

In the Wechsler-Bellevue (188) standardization sample, a correlation of .64 was obtained; this dropped to .53 when mental defectives were omitted. Lewinski (102), using the same test on a sample of 1,000 white males, found a similar value, .56, while the vocabulary sub-test alone correlated .57. The Terman vocabulary also is closely associated with education, as indicated by correlation coefficients ranging from a low value of .49 reported by Weisenburg, Roe, and McBride (192) to a high of .67 for Altus's (2) Army recruits. Shakow and Goldman (141), using a sample that was selected to be representative of the population in education, found a relationship amounting to .64. Heston and Cannell (85), using the Terman vocabulary with a wholly rural population, report a coefficient of .50.

Lorge (107) has carried out several studies aimed at measuring the degree of relationship between educational level attained and Otis I.Q. His correlation coefficients vary from .44 to .66 for various groups in New York City. Benson (16) obtained a coefficient of .57 between tests administered to students in the sixth grade in 1923 and their educational attainments almost twenty years later.

The evidence is also quite consistent in supporting the finding of a rise in average intelligence with each higher educational group. The Yerkes (202) material on World War I soldiers is broken down by rank, race, and country of birth. For the Southern colored draft, scores rise steadily from an average of 7.2 for those

with four or less years of education to 63.8 for the college group. For the Northern colored draft, the same trend occurs with a rise from 17.0 to 90.5. Among the foreign born, those with four or fewer years in school average 21.4 on Alpha, and those in the college group score 91.9. The figures for the white draft are 22.0 and 117.8 respectively. The officers are the only group that shows a reversal, and this is in the lower educational groups in which N's may be small. For the zero through four group, the mean is 112.5; and this drops to 107.0 in the five through eight group before rising steadily to 143.2 for those with college training. Similar results have recently been reported by Anstey, Dowse and Duguid (6) for a group of 500 British soldiers. Scores on a pictorial code completion test varied from 36 for those with least education to 105 for the college group. On an information test, the rise was from 5 to 68. In both cases there were no reversals.

Some interesting results are available on performance at the upper intelligence levels. Terman and Oden (165) have reported the scores obtained in a follow-up testing of their gifted group with a very difficult Concept Mastery Test. College graduate averages were 107.2 and 100.4 for men and women respectively. For those who started but did not finish college, the values were 85.4 and 86.8, while for the high school graduates the average score of the men was 78.7 and of the women 79.4. Wolfle and Oxtoby (200) report that the average college graduate has an AGCT score of 126, while for graduate students the figure rises to 129. The average Ph.D. in the sciences scores at about 138. The authors suggest that, if all types of degree-granting institutions were included, the figure of 126 might drop about five points. The conclusion is consistent with Traxler's (181) report that, over a period of ten years, teachers college freshmen averaged at about the same level as junior college freshmen on the ACE, both beings about 3.8 I.Q. points below liberal arts college freshmen.

As might be expected, other studies based on vocabulary measures also indicate consistent differences as a function of educational level. O'Connor (127) reports an average of 76 errors out of 150 items for 300 high school freshmen, 42 errors for 700 college freshmen, and 27 errors for 1,000 college graduates. For the field trials carried out by Hagen and Thorndike (74) results are given in terms of educational level for four of the areas in which the tests were administered. Although the vocabulary test

used was identical with that employed in the present study, the results are not strictly comparable because of the divergent ways in which guessing was handled. The medians were 3.3 for one through four years of education, 5.1 for five or six years, 5.5 for seven years, 6.4 for eight years, 7.4 for nine years, 8.3 for ten or eleven years, 9.7 for high school graduates, 11.5 for thirteen through fifteen years, 13.9 for college graduates, and 15.1 for those with some graduate work. The arithmetic test shows a consistent rise with an increase in education. The mechanical comprehension scores also increase as a function of education, but the effect is not as marked, and there are several slight reversals in median values.

Although these results indicate quite conclusively a high relationship between intelligence and education, they do not tell us whether this is a function of the causal action of education or the increasing effects of selection at each higher educational level. The evidence is quite strong on the first point. There seems little doubt that education does raise intelligence. In an early study, Lorge (108) obtained test results from a representative sample of eighth grade school children in New York City on tests of reading and arithmetic administered in 1921-22. These tests were similar to present tests of *general intelligence* and were used on a sample totaling 863. Of these, 131 cases forming a representative group were retested with the Otis some 20 years later. When grouping is carried out on the basis of original test scores, there is a tendency for Otis scores to rise with increased education even though original intelligence is essentially held constant. These results have been questioned (4) because the control for original intelligence is based on rather large class intervals, 10 points or more; those at the top of each interval may have continued their education longest and obtained the highest Otis scores. Furthermore, the N's are quite small. Husén (91) has, however, reported a similar study with the retesting done at a ten-year interval. Those who had received least schooling decreased in I.Q. by 1.2 points, while those who had had the most increased some 11.0 points. The original testing was done in the third grade on 1,549 school children, and the follow-up on the males when they entered the Norwegian Armed Services.

Perhaps the most interesting study is that by Tuddenham (182) who administered the AGCT and the Alpha to 768 enlisted

men. The AGCT distribution was similar to that for the Army as a whole, and thus the group was assumed to be representative. The Alpha median obtained was 104 as compared with 62 for the World War I draft. Some 83 per cent of the World War I draftees fell below the World War II median. Presumably the major factor in the rise in manifest intelligence is the increase, in the intervening 25 years, of the average educational level in this country from eight to ten years completed. Nevertheless, there is reason to believe that increased exposure need not be supplied by the educational system. O'Connor (127), in testing twenty executives who rose to high positions despite the fact they left school at the age of fifteen, found that this group averaged seven errors on the vocabulary test, a figure identical with that of executives who had had greater educational advantages.

Although the data suggest that part of the education-intelligence correlation is a result of education per se, there is also reason to believe that selection occurs. At the time of college admission, a number of applicants are screened out either because of low high school grades or low test scores. There is also evidence that at all levels of schooling drop-outs are likely to be less intelligent than those who stay in school. Benson (16) found in a follow-up study of 1,680 cases, first tested in 1923 in the sixth grade, that those who completed eighth grade or less had a median I. Q. originally of 95. The high school incompletes averaged 108; the high school graduates, 120; the college incompletes, 122; the college graduates, 132; and those who had some graduate work, 134. Just as with Terman's (166) gifted children, those who were originally intelligent were much more apt to achieve a higher educational level. Almost 70 per cent of the gifted group graduated from college as compared with less than 10 per cent of the total population of a similar age.

Occupation

Table VII contains information on the intelligence of the four occupational levels. It is apparent that the effort to establish groupings in terms of the amount of verbal intelligence required for job performance was quite successful. All four levels are clearly differentiated, the differences between means being sizable and very reliable. The results are quite consistent with those

TABLE VII INTELLIGENCE OF OCCUPATIONAL GROUPS (EMPLOYED)

Level	Mean	Standard Deviation	N
Highly Skilled	14.60	2.73	91
Skilled	12.00	3.13	236
Semi-skilled	10.27	3.18	286
Unskilled	8.84	3.10	132
		t Values	
	Skilled	Semi-skilled	Unskilled
Highly Skilled	6.96	11.66	14.65
Skilled		6.22	9.29
Semi-skilled			4.29
		P Values	
	Skilled	Semi-skilled	Unskilled
Highly Skilled	<.001	<.001	<.001
Skilled		<.001	<.001
Semi-skilled			<.001

obtained in the past with similar scales of occupation-intelligence demand. Ball (10) did follow-ups, in 1938, on the occupations of two groups of children tested in 1918 and 1923, respectively, with the Pressey Mental Survey Test. Converting the occupational information to Barr Scale values, he obtained correlations of .71 and .57. Presumably the higher value obtained with the earlier group is due to the fact that the longer time between test and follow-up allowed those with higher ability to work into higher level occupations. Again using the Barr Scale, Weisenburg, Roe, and McBride (191) found that for their group of about 70 hospital patients the correlation with the Stanford-Binet was .44; with the Terman Vocabulary, .52; and with the Thorndike Vocabulary, .59. The Fryer Scale, which is a standard score scale of the actual intelligence of different occupations as measured by the Army Alpha Examinations of World War I draftees, has been found by Lorge and Blau (109) to correlate .76 with the Barr Scale. This value rises to .78 (110) when the Academic Ability Scale of the Minnesota Occupational Rating Scales is used as a means of grouping occupations in terms of intelligence level.

The results of the present study as well as those just mentioned all point to the fact that the relationship between occupation and intelligence is approximately the same as that previously

noted for education. The Benson (16) and Ball (10) studies taken together suggest that both educational and occupational level may be predicted from tests given during grammar school, and the Terman and Oden (165) data on gifted children certainly substantiate this conclusion.

In the present study, for the whole employed group of 745 cases, the mean score is 11.10 and the standard deviation 3.54. The corresponding values for the 423 housewives included in the sample are 10.78 and 3.33. The "t" for the differences between means is 1.52 which is not significant.

The data presented in Table VIII is of interest primarily because of the extensive use to which the occupational classification system devised by the Bureau of the Census has been put. Although the number of cases in several of the categories is quite small, the results suggest that the Census groupings do approach an intelligence level system. The professional, technical, and kindred workers are reliably above all other groups. The managers, officials, and proprietors do not differ significantly from the other white collar groups, the clerical and sales workers; but they are reliably more intelligent than the craftsmen, foremen, and kindred workers. Again, the clerical and sales groups do not differ, but the clerical workers, like the managers, are superior to the skilled craftsmen. Sales workers as a group appear to be more intelligent than the operatives and kindred workers, while showing no reliable difference from either farmers or the craftsmen, foremen, and kindred workers. The remaining five groups—craftsmen, farmers, operatives, laborers, and service workers—do not differ markedly in intelligence. The only significant difference is that between craftsmen and service workers. The lowest average is obtained by service workers, not by unskilled laborers. The farmers as a group appear to fall somewhere between the skilled and semi-skilled.

To the best of my knowledge, no strictly comparable information is presently available. Anderson, Brown, and Bowman (5) have classified the Harrell and Harrell data on Air Force enlisted men in World War II and found a mean AGCT score of 122 for the professional group, 117 for managers and proprietors, 115 for clerical workers, 105 for skilled workers, 99 for semi-skilled workers, and 96 for the unskilled. The same material has been

TABLE VIII INTELLIGENCE OF OCCUPATIONAL GROUPS, CENSUS CLASSIFICATION (EMPLOYED)

Group		Mean	Standard Deviation	N
0	Professional	14.56	2.88	68
1	Farmers	(10.22)	(3.56)	45
2	Managers	12.60	3.20	78
3	Clerical	12.40	2.96	102
4	Sales	(11.52)	(3.00)	48
5	Craftsmen	10.62	3.24	102
6	Operatives	10.02	3.27	154
7	Service	9.19	3.22	81
8 and 9	Laborers	9.63	3.18	67

t Values

	1	2	3	4	5	6	7	8 and 9
0	7.07	3.84	4.69	5.46	8.07	9.85	10.51	9.39
1		3.78	3.84	1.89	.66	.35	1.65	.91
2			.43	1.87	4.07	5.70	6.66	5.55
3				1.68	4.08	5.91	6.98	5.75
4					1.62	2.82	4.03	3.19
5						1.44	2.96	1.95
6							1.85	.82
7								.83

P Values

	1	2	3	4	5	6	7	8 and 9
0	$<.001$	$<.001$	$<.001$	$<.001$	$<.001$	$<.001$	$<.001$	$<.001$
1		$<.001$	$<.001$	$<.10$	$>.10$	$>.10$	$>.10$	$>.10$
2			$>.10$	$<.10$	$<.001$	$<.001$	$<.001$	$<.001$
3				$<.10$	$<.001$	$<.001$	$<.001$	$<.001$
4					$>.10$	$<.01$	$<.001$	$<.01$
5						$>.10$	$<.01$	$<.10$
6							$<.10$	$>.10$
7								$>.10$

converted to standard score I.Q.'s by Johnson (95). He reports a value for professional men of 120; for semi-professional and managerial workers, 113; for clerical, skilled, and retail workers, 108; for the semi-skilled and minor clerical and business, 104; for slightly skilled workers, 96; for laborers, both farm and non-farm, 95; and for farmers, 94. The Harrell and Harrell data have also been grouped according to the United States Employment Service classification as presented in the Dictionary of Occupational Titles (38), but in many groups the number of occupations represented is too small to give reliable figures.

Race

As might be expected, there is a sizeable difference in mean vocabulary score between the 1,347 white subjects and the 153 Negroes. The white mean is 11.06 with a standard deviation of 3.41, while the Negro mean is 8.08 with a standard deviation of 2.72. Since the two standard deviations are significantly different, "t" was computed without pooling the sum of squares, and a value of 12.41 was obtained ($P<.001$). Splitting the total distribution at the median gave a χ^2 of 90.82 ($P<.001$). As indicated by the reduced standard deviation, the Negro scores tend to cluster more closely about the mean. Only one Negro obtained a score above 15.

Similar results have been obtained many times in the past. The median Negro I.Q. in twenty-seven studies reviewed by Klineberg (97) was 86 as compared with a theoretical value for the population as a whole of 100. The range for different investigations was from a value of 58 for a group in Tennessee to 105 for a group in Los Angeles. Johnson (95) computed the average Negro I.Q. in World War I at 83, using the white draft sample as a reference. Fulk and Harrell (64) found a mean Negro AGCT score of 68.5 as compared with 95.1 for whites, in their study of samples of over 2,000 Army Air Force recruits from each racial group. The rejection rate for mental deficiency in World War II as reported by Ginzberg and Bray (70) was about 152 per thousand for Negroes, while the rate was 25 per thousand for whites. The white rate is raised considerably by figures of over 50 per thousand in the Southeast and Southwest. Negro rates are lowest in the Northwest and Far West with values of 40 and 50 per thousand respectively and rise to over 200 per thousand in the Southeast. More recent material, available from the testing of Air Force basic trainees at Lackland Air Force Base in 1952 (94), indicates that the one to six ratio between white and Negro failures is still maintained. The rate of failure on the group psychological tests was 10.0 per thousand for whites and 58.7 per thousand for Negroes.

It has been suggested that these differences in test scores are a function of differences between white and Negro cultures, and that Negroes would do much better if they were given tests containing items that did not place heavy emphasis on learning sets that are much more likely to be developed in the white culture.

Some recent work by McGurk throws light on this hypothesis. In one study (116) he employed a test consisting of items which a number of judges had divided into two groups, according to whether they were or were not highly related to white cultural sets. He found that, when Negro high school seniors were split into groups of high and low socio-economic status (high and low quartiles on the Sims Scale), the higher socio-economic group did better on both types of items, but their advantage was somewhat more pronounced on the non-cultural items. When a white group was matched with the Negroes on age, school attendance, school curriculum, and Sims score (115), the racial difference was greater for the non-cultural items than for the cultural. At the lower socio-economic levels, the Negroes actually had slightly higher scores than the whites on the items that had been selected as representative of the white culture. At the higher levels, however, the Negroes scored an equal distance below the whites on both the cultural and non-cultural questions. The implication is that Negroes do not show any special handicap in dealing with test material that emphasizes the white culture. Apparently they do at least as well on those items on which the whites might be expected to excel as they do on those that could not offer a special cultural advantage to the whites.

A good deal of evidence on high I.Q.'s among Negro children has been reviewed by Jenkins (93). Sixteen studies report I.Q.'s of above 130; and twelve report cases above 140, almost all of these being from Northern urban communities. Jenkins himself studied eighteen cases with Stanford-Binet I.Q.'s above 160, four of these being above 180, and one above 200. Such high I.Q.'s could not be obtained if native potential, environmental stimulus potential, or motivation were at a low level.

Much has been said since World War I about the finding that whites from four Southern states—Georgia, Arkansas, Kentucky, and Mississippi—scored lower on the Army Alpha than Northern Negroes from New York, Ohio, Illinois, and Pennsylvania. Actually, as Garret (66) points out, the Negro scores in the four Northern states were well below the whites in the same area with the average Southern Negro having an I.Q. of about 80, while in the North the mean is between 85 and 90 (69). Alper and Boring (1) found that, when the data on the Army Alpha and Beta tests were combined (the Beta being a non-language measure), the

Negro average in the four Southern states was 9.8 and the white 12.7, while in the four Northern states the Negroes averaged 12.0 and the whites 14.1. The advantage of the Northern Negro over Southern whites disappears, although there is no doubt that Negroes in the North do much better than those in the South.

This geographical differential may be a function of selective migration or of an enriched environment that, combined with appropriate motivation, permits Negroes to raise their test scores after moving to the North. Klineberg (96) carried out a number of studies that seem to support the second hypothesis. The school grades of children whose families moved to the North were not much different from those who stayed. In Birmingham, Alabama, the migrants did somewhat less well in school than those who remained, while in Nashville, Tennessee, and Charleston, South Carolina, they did a little better. Conditions in a specific area seem to be more important than any over-all trend. Several studies indicate a continuous rise in I.Q. with length of residence in New York City, with the children of Negro migrants coming close to those of the native born. Similar results were obtained by McAlpin (112) and Long (105) in Washington, D.C. Lee (100) was able to use a somewhat superior experimental design, based on successive administrations of the Thurstone Primary Mental Abilities Tests, to school children in Philadelphia. Every score of the Negro children, except that for Memory, improved with length of residence, whereas the native-born showed no improvement on successive testings. There seems to be little doubt that increased actual exposure permits Negro migrants to raise their functioning intelligence and thus their test performance well above the level they possessed in the South. Presumably the superiority of Northern Negroes is primarily a function of this fact.

When an effort is made to hold education constant by comparing Negroes and whites with the same amount of education, the racial differences is reduced but still evident. Information is available from Yerkes (202) on World War I recruits, from Fulk and Harrell (64) on World War II Army Air Force inductees, from Altus (2) on World War II illiterates, and from a number of studies, such as that by McGurk (114), on school children. In every case, the Negroes score well below whites even though both groups have had the same *amount* of formal education.

Witty (197) reports that among illiterates assigned to special training units during a seventeen month period in World War II, 15.8 per cent of the whites and 12.9 per cent of the Negroes were found unsuitable for training and discharged. The rest were able to attain the standards for minimum proficiency as soldiers and were assigned to active duty after from three to sixteen weeks of schooling. Those who entered such training were, of course, selected for suitability. As Anastasi and Foley (4) point out, these results indicate that the selection devices were equally effective in both groups and, more important, that education can be absorbed rapidly by many whites and Negroes alike if it is made available. As with the Klineberg studies, increased actual exposure to educational materials will raise the level of functioning intelligence.

Other studies have attempted to control socio-economic status and compare Negro and white I.Q.'s. Arlitt (7) matched school children on the basis of their father's occupation. He found that in the same school district the Stanford-Binet I.Q. of children of native white parentage was 106.5 and of Negro parents 83.4. When the comparison was limited to children whose fathers were unskilled or semi-skilled workers, the white figure dropped to 92.0, while that for the Negroes remained the same.

None of these studies tell us anything about racial differences in native potential. As I previously pointed out, intelligence tests do not in any sense tap native, inherent capacities. In spite of a good deal of research and a rather large body of literature, we know no more today about such capacities and their relation to racial groups than we did forty years ago. In order to determine whether or not such differences exist, it would be necessary to equate Negro and white groups on all aspects of environmental stimulus potential that might be related to performance on the measuring instrument. In addition, and this is perhaps the crucial factor, motivation to develop learning sets would have to be controlled. The children, white and Negro, would have to attend the same schools for the same number of days a year and come from the same or practically identical homes. The teachers and parents not only would have to assure an equally rich environment for the white and Negro children but also would have to instill the same degree of motivation to make use of this environmental stimulus potential. None of the studies reviewed achieved anything like this kind of control. The factor that is most difficult to deal with is probably

that of motivation. Negroes do not have the same expectations of achievement as whites have, not even at the same socio-economic level. They expect to be restricted to certain occupations and to be deprived of many cultural advantages that are open to whites. It seems highly probable that Negroes, therefore, are not even motivated to make full use of such environmental opportunities as are offerred. Learning sets may not be developed because they are presumed to have no real value for the individual. Obviously, setting up an experiment to control for motivational differences that are a function of caste values would be a prodigious undertaking. It may be that knowledge will in fact have to await the direct measurement of native potential on a physiological level.

Nevertheless, we do possess the information that is really important for the society as a whole. We know that the reasoning ability of Negroes as a group is below the white level in practically all content areas. We know that this level can be raised by increased actual exposure, that illiterates can in many cases be taught to read and write, and that the less intelligent can be helped and motivated to develop more learning sets. These facts are no more true for Negroes than any other group in the population, but in view of the fact that the Negroes as a race have a lower vocabulary score than any other group dealt with in this study (except those with no education at all) they would appear to have a high priority in any effort to change present conditions. Whether or not white and Negro differences in intelligence can be completely eliminated is still an open question.

Social Class

The agreement between the social class distribution obtained and various figures reported by Centers (31, 32, 33, 36) is quite good. He reported on a number of separate national samples. For each class the present percentage falls within the range of these prior surveys. The upper class percentage of 3.1 falls between the 3 and 6 per cent figures previously found. For the middle class, Centers reports figures of 35 and 43 per cent, while the present value is 38.6. The working class response is given by 52.7 per cent as compared with a range from 51 to 59; and the lower class value of 4.1 per cent is within the range established by Centers, namely 1 to 6 per cent.

P.M.

There is only a limited amount of information available as to what the subjective class identification question really measures. In one survey (36) respondents were asked which one of a number of factors they considered most important in determining whether or not a person belonged to their class. Beliefs and attitudes were primary for 38 per cent, occupation for 23 per cent, money for 9 per cent, education for 8 per cent, and family for 7 per cent. Also, there appears to be a rather high relationship between class identification and the more objective measures such as Warner's Index of Status Characteristics (35). The majority of those having scores between 12 and 15 on the Warner scale consider themselves upper class. Those with scores of 15 through 50 most frequently choose the middle class. Values of 51 or more are associated with working class identification. On the basis of these results, Centers concluded that his upper class is similar to Warner's upper class group, his middle class to Warner's two middle classes, his working to Warner's upper-lower, and his lower to Warner's lower-lower. In general, the agreement is least good for the upper and lower classes, the two groups which Centers frequently was forced to drop from his analysis because of an inadequate number of cases. This particular study was carried out in metropolitan Los Angeles County. No data are given on the age range of the respondents.

Table IX gives the information on the intelligence of the various social classes. The rise in average intelligence from the lower to working to middle class is sizable and highly reliable, even when correction is made for differences in standard deviation. The upper class mean falls between the lower and working class values and is significantly below that of the middle class. There are also rather marked differences in the size of the standard deviations. The upper class value of 4.46 is by far the largest of any obtained in this study. The standard deviations tend to decrease in size at each lower class level; the working and lower class values do not differ significantly.

The results appear to be in general agreement with prior studies except for the upper class statistics which will be discussed at some length later. Neff (124) reviewed some 31 investigations, carried out up to 1938, all of which indicated a positive correlation between intelligence and social class indices. For the eight studies which presented actual coefficients, the values ranged

TABLE IX INTELLIGENCE OF CLASS IDENTIFICATION GROUPS

Class	Mean	Standard Deviation	N
Upper	(9.74)	(4.46)	47
Middle	11.86	3.54	579
Working	10.24	3.14	790
Lower	8.73	2.75	62

t Values	Middle	Working	Lower
Upper	3.16[1]	.75[2]	1.35[3]
Middle		8.71[4]	8.24[5]
Working			3.67

P Values	Middle	Working	Lower
Upper	$<.01$	$>.10$	$>.10$
Middle		$<.001$	$<.001$
Working			$<.001$

[1] Variances significantly different: $\chi^2 = 7.97$ P $<.01$
[2] $\chi^2 = .13$ P $>.10$
[3] $\chi^2 = .54$ P $>.10$
[4] $\chi^2 = 37.18$ P $<.001$
[5] $\chi^2 = 33.94$ P $<.001$

from .21 to .53. These values are consistent with those reported ten years later by Anastasi and Foley (4). The average correlation coefficient obtained appears to be about .40. This is probably an underestimate, because socio-economic status tends to be skewed, with the majority of cases falling toward the low end of the distribution, while intelligence is distributed in accordance with the normal curve. Under such conditions, the appropriate statistic is not the Pearson "r" but the correlation ratio or eta. Use of eta in the above studies would add, presumably, to the degree of relationship obtained.

In the Thorndike and Gallup (172) survey, which utilized the vocabulary test that we have used, information was obtained on the weekly income of the respondent's family. This variable proved the most sensitive of any employed in differentiating between various population groups. The range between the median of the lowest income level, those making less than $20 a week in 1942, and the highest, those making over $40, was about 5 points.

A number of investigators have employed the Sims Record Card or some modification of it as an objective measure of socio-

economic status. These include McGurk (115, 116), whose studies of class differences in intelligence among Negroes have already been noted, and Stroud (155) who reports "r's" of .49 and .31 between the Sims measure and Otis score in two studies of elementary school children. McGehee and Lewis (113) selected 12,000 cases, consisting of the top and bottom 10 per cent as well as a middle range group, from the 45,000 school children in grades four through eight tested with the Kuhlmann-Anderson Intelligence Test as part of the Coordinated Studies in Education. These children came from 455 schools in 310 communities in 36 states. The Sims score increased steadily as a function of intelligence, with the superior 10 per cent obtaining a score of 8.09, the average group 6.61, and the lowest 10 per cent 4.18.

Much of the more recent work has involved the use of the objective indices of social class developed by Warner and his associates (187). Havighurst and his co-workers have conducted a number of studies of this type in a midwestern community of some 10,000 people. A group of ten year olds (81), who were tested with the Stanford-Binet, Cornell-Coxe, Goodenough Draw-a-Man, Iowa Silent Reading, Minnesota Paper Form Board, Porteus Maze, Minnesota Mechanical Assembly Test for boys, and Chicago Mechanical Assembly Test for girls, differentiated clearly along class lines on all tests. Only the lower-middle, upper-lower, and lower-lower classes were sufficiently well represented for the computation of means. Similar results were obtained for the sixteen year olds (92), using the Stanford-Binet, Wechsler-Bellevue, Iowa Silent Reading, Minnesota Paper Form Board, and Chicago Mechanical Assembly Test for girls. As previously noted, the Minnesota Mechanical Assembly Test for boys was not related to social status in this group. Another group of thirteen year olds was given the Thurstone Primary Mental Abilities Test (82). In every case there was a steady rise in score from the lower-lower to upper-lower to lower-middle class. The correlations between factors and the Warner Index of Status Characteristics ranged from .21 to .42. In a final study by Schulman and Havighurst (140), a vocabulary test was administered to all ninth and tenth graders plus all other fourteen year olds in the city. Again marked differences were obtained between the three class levels previously employed. Vocabulary correlated .46 with the Index of Status Characteristics.

There are in addition several studies that have included sufficient cases above the lower middle class to give meaningful results. Britton (27) reports correlations of .51, .42, .50, and .53 for the relationship between the Warner Index of Status Characteristics and the Henmon-Nelson, Otis Alpha Verbal, Otis Alpha Non-verbal, and Kuhlman-Anderson measures of intelligence, respectively. The sample consisted of 330 nine, ten, and eleven year olds. Hagen and Thorndike (74) also applied the Warner measure to their sample, taking a weighted sum of occupational level, house type, and neighborhood rating. In the four areas in which the testing was carried out, there was a steady rise in test score as a function of social class. This was true for all four classes and for all tests —vocabulary, arithmetic, and mechanical comprehension. There were no reversals.

Returning to the results of the present study, the data for those who identify with the upper class seem quite inconsistent with prior conclusions. Unfortunately, a number of the earlier studies did not employ sufficient cases at the upper class level for adequate comparison. Nevertheless, results such as those obtained by Hagen and Thorndike suggest that, for objective measures of social class, intelligence continues to rise. There is some indication, however, that this may not be true for the younger age groups. Phillips (132) reports no significant difference between middle and upper class junior high school students on the Terman Group Test; both groups were far superior to the lower class. Eells et al. (54) found no relation between social status and I.Q. in upper-middle and upper class nine and ten year olds despite the existence of such a relationship among thirteen and fourteen year olds. To the best of my knowledge, there are no studies that report a reversal, as found in the present study, with the upper class markedly inferior to the middle class.

In order to check on the actual composition of the upper class sample of 47 individuals, frequencies on other background variables were compared with expected frequencies derived from the Census figures for the population as a whole. The question was whether the group did in fact contain a much higher percentage of white, high education, highly skilled workers than the population or whether a number of people who reported upper class membership were in some way deviant from these expectations. The results were in many ways surprising. Over 27 per cent of the

upper class sample were Negroes as compared with a population figure of about 10 per cent. About 19 per cent were in the 10 through 13 age range, a figure over 10 per cent above that in the population. Among the adults who are no longer in school, there was, as might be expected, an increase of some 25 per cent over the population as a whole in the number who had attended college; but there was also an increase of about 17 per cent in the number who had completed less than seven years of education. In terms of the occupational classification system based on intellectual demand, the expected rise in number of highly skilled workers occurred: about 37 per cent of the upper class employed did work in high level positions, as compared with some 12 per cent of the total sample. But 31 per cent of those who reported upper class membership were unskilled workers as compared with some 18 per cent of the larger sample. As regards religion, the upper class was almost entirely Protestant. Geographically, every area was under-represented except the Border and Deep South. In fact, about 64 per cent of the upper class group were Southerners, a rise of 36 per cent over expectations.

Although the upper class sample apparently includes many individuals who would be so categorized by more objective measures, such as those employed by Warner, it also contains a number of people with little education and in unskilled jobs, who would be classified quite differently. The latter not only reduce the mean for the group as a whole but also account for the enormous standard deviation. As a check, the average vocabulary score was computed for two independent samples of people who not only reported upper class membership but also came from groups where the probability of their meeting objective criteria for membership in that class was very high. One group consisted of 73 Princeton University undergraduates from the freshman and sophomore classes. The mean score of 14.15 is well above the average for their age group and also exceeds the middle class by a sizable amount. The second group consists of 29 men who identified with the upper class among 44 top-level executives studied recently by the author and John Culver (120). The average vocabulary score in this group was 18.17, a figure which is practically identical with the executive group as a whole.

What leads people who do not meet the objective criteria for membership to identify with the upper class is impossible to say.

It may be that in the younger age group class attitudes are not yet highly structured so that wish may at times be more important than reality. Centers (34) reports a decrease in upper and mildle class identification with increasing age in a group of high school students. The upper class figure drops from four per cent of those fifteen years or less to one per cent of those eighteen and above. The corresponding drop in middle class identification amounts to about eight per cent. This tendency might be expected to be even more pronounced at lower age levels and would thus account for the high proportion of upper class identification in the ten through thirteen year olds. Among the adults there may be a wish-fullfillment factor. It might be, however, that the individual is employing criteria for class membership that are quite specific to his particular group. It would seem possible that low education, low-level occupation individuals not only consider themselves upper class, but also are considered upper class by their community, if the group is in some way isolated by racial or geographical barriers from the larger society.

Whatever the reason for identifying, it is apparent that the upper class sample is highly heterogeneous in intelligence, tending toward a bimodal distribution. The bimodality of educational and occupational levels in the upper class sample is even clearer. Centers (35) has presented distributions of subjective class identification frequencies for the various levels of Warner's Index of Status Characteristics. There is no tendency for those identifying with the upper class to cluster at the high *and* low levels of the Warner Index. Centers' material, however, was limited to the Los Angeles area which differs in many respects, including racial composition and educational level, from the population as a whole. In addition, the finding that identification with the upper class, even though the usual objective criteria are lacking, is most prevalent in the South makes it improbable that Centers would have found such a phenomenon.

CHAPTER 5

INTELLIGENCE AS RELATED TO OTHER VARIABLES

The variables of sex, age, rural-urban residence, geographical area, and religious preference, which are discussed in this chapter, have little in common except that they do not appear to be directly related to social status. They do not differentiate markedly between groups in the population. As compared with a range of group means from 6.96 to 14.60 for the variables treated in Chapter IV, the extreme values are 8.84 and 12.71 for groups treated in this chapter. While 52 of the 68 comparisons made in Chapter IV were significant at the 5 per cent level or better, only 45 of the 88 comparisons made in this chapter are significant at the same level of confidence. Apparently the so-called social stratification variables are most closely associated with environmental stimulus potential, motivation, and native potential, the determinants of intellectual functioning.

Sex

The mean vocabulary score of the 721 males, included in the sample of 1,500, was 10.75 and the standard deviation 3.48. These figures compare with values of 10.78 and 3.44 for the females. The "t" value for the difference between means is .17. Neither the means nor the standard deviations come close to being significantly different.

This conclusion is consistent with the over-all results of other studies, although most individual investigations report a slight

tendency in favor of males or females. Kuznets and McNemar (98) reviewed twelve studies of large groups with wide age ranges and found that of 56 comparisons on a variety of tests of *general intelligence,* 28 favored males, 25 females, and 3 were equal. The Thorndike and Gallup (172) survey of the voting population indicated a negligible sex difference, with the males having a median of 10.87 and the females 11.27 on the 20-word vocabulary test. Shakow and Goldman (141) tested a sample, which was selected to be respresentative of the population on age and education, with the Terman Vocabulary and found no reliable sex difference. Similar results were obtained by Weisenburg, Roe, and McBride (191) with the Thorndike Vocabulary as well as the Stanford-Binet and Terman Vocabulary.

The lack of difference in variability between males and females is contrary to the early theory that males were more variable in many characteristics. The evidence has been reviewed rather extensively by Anastasi and Foley (4). They point out that a greater frequency of male geniuses and institutionalized male mental deficients is to be expected as a result of cultural factors and need not indicate greater variability among males. Many occupations are essentially closed to females in our society, and the probability of achieving eminence is accordingly reduced. Correspondingly, males, because they are expected to enter the labor force, are more likely to be found mentally retarded and institutionalized because of an inability to maintain themselves in a competitive society. A number of large scale studies indicate that, as with mean scores, sex differences in variability tend to be slight when they are found and do not appear to be consistently in favor of one group or the other.

Age

The data on the relationship between age and intelligence presented in Table X are in many ways interesting. The means rise steadily to a peak somewhere in the range between 35 and 44 and then drop gradually to a level (for the small group of cases aged 75 and over) below that of the 14 through 17 year olds. The 10 through 13 year olds score reliably below all other groups except those 75 and over. The same tendency to perform below all older age groups except the oldest occurs at the 14 through 17 level. Somewhere in the range 18 through 24 the curve begins to

TABLE X INTELLIGENCE OF VARIOUS AGE GROUPS

Age	Mean	Standard Deviation	N
10-13	8.84	2.80	124
14-17	9.71	2.81	110
18-24	10.63	3.06	157
25-34	11.20	3.33	283
35-44	11.58	3.29	270
45-54	11.20	3.90	219
55-64	10.69	3.51	175
65-74	10.64	3.56	118
75 or above	(9.59)	(3.95)	39

t Values

	14-17	18-24	25-34	35-44	45-54	55-64	65-74	75 or above
10-13	2.36	5.04	6.88	8.01	6.38[1]	5.00[2]	4.29[3]	1.09[4]
14-17		2.49	4.14	5.22	3.92[5]	2.58[6]	2.19[7]	.17[8]
18-24			1.77	2.94	1.58[9]	.14	.02	1.77
25-34				1.35	.00[10]	1.55	1.50	2.75
35-44					1.15[11]	2.71	2.52	3.43
45-54						1.34	1.29	2.36
55-64							.12	1.72
65-74								1.54

P Values

	14-17	18-24	25-34	35-44	45-54	55-64	65-74	75 or above
10-13	$<.02$	$<.001$	$<.001$	$<.001$	$<.001$	$<.001$	$<.001$	$>.10$
14-17		$<.02$	$<.001$	$<.001$	$<.001$	$<.02$	$<.05$	$>.10$
18-24			$<.10$	$<.01$	$>.10$	$>.10$	$>.10$	$<.10$
25-34				$>.10$	$>.10$	$>.10$	$>.10$	$<.01$
35-44					$>.10$	$<.01$	$<.02$	$<.001$
45-54						$>.10$	$>.10$	$<.02$
55-64							$>.10$	$<.10$
65-74								$>.10$

[1] Variances significantly different: $\chi^2 = 13.71$ $P < .001$
[2] $\chi^2 = 18.13$ $P < .001$
[3] $\chi^2 = 11.38$ $P < .001$
[4] $\chi^2 = .14$ $P > .10$
[5] $\chi^2 = 7.24$ $P < .01$
[6] $\chi^2 = 10.63$ $P < .01$
[7] $\chi^2 = 7.21$ $P < .01$
[8] $\chi^2 = .80$ $P > .10$
[9] $\chi^2 = 1.01$ $P > .10$
[10] $\chi^2 = .30$ $P > .10$
[11] $\chi^2 = 2.07$ $P > .10$

flatten out, and a reliable difference appears only in the comparison with the 35 through 44 group. The grouping of those 25 through 34 discloses a score significantly above the very oldest. In the range 35 through 44 the peaking is sufficiently pronounced so that reliable differences are obtained for all comparisons except those with the age groups immediately above and below. The mean score of those in the next ten-year span remains above those 75 and over, but for the 55 through 64 and 65 through 74 groups this difference disappears.

With regard to the differences in standard deviation, the most pronounced finding is the reliable difference which appears between the two youngest groups and all those above the age of 44. The restriction of range is apparently a result of the fact that these younger individuals, primarily students, have not been exposed to a large enough vocabulary to develop learning sets which would make it possible for some to score at the top of the distribution. Actually the highest score among those 10 through 13 is 16, and among those 14 through 17 is 17. In both cases, only one person attained these levels. There are also reliable differences in standard deviation between the 45 through 54 group and all younger categories, with those 45 through 54 exceeding all groups below them.

Although the results suggest that for any given individual there will be an increase in verbal ability up to the late thirties or early forties and then a decline, the possibility still exists that the regularity of the curve is not a function of the nature of the human growth process but rather of the interaction of several variables. Among school children the degree of actual exposure is primarily a function of age, with the older group having essentially a richer environment. The higher education and consequent increased actual exposure of the older children would make it possible for them to achieve higher test scores. Yet, there has also been a consistent rise in the educational level of the population for many years. The average person of 65 today has much less education than his counterpart who is 25. The implication is that the age-intelligence curve is a direct function of actual exposure, with native potential a constant at each age level, but that, because of differences in educational opportunity, the degree of actual exposure has not been the same for different age groups. Consequently, the curve may not represent the best prediction of in-

TABLE XI INTELLIGENCE DIFFERENCES FOR AGE GROUPS WITHIN EDUCATIONAL LEVELS

Years Completed	Age Group	Mean	Standard Deviation	N
8 or less	35 - 44	9.21	2.76	82
8 or less	55 or more	9.23	3.21	228
9 or more	35 - 44	12.61	2.95	188
9 or more	55 or more	13.42	2.57	104

tellectual changes throughout life. For most people there would appear to be increments of actual exposure over time.

In order to check on the possibility that the apparent decline with age is in fact a result of the limited education of the older groups, an attempt was made to control for educational level. The procedure involved splitting the 35 through 44 age group into two sections, one consisting of all who had completed 8 years of education or less, and the other of those with more than 8 years completed. A similar break was carried out on a second group, consisting of the age categories that were both older and significantly less intelligent than the peak group, that is, of those above the age of 55. The resulting means, standard deviations, and sample sizes are indicated in Table XI. The N's indicate that for the younger group more than two-thirds fall in the higher educational category, while for the older group this relationship is reversed.

Applying the "t" technique to the differences between the two age groups at the same educational level reveals that there is no reliable difference within the lower educational category, the "t" value being .05; but among those with more than grade school education, the difference in favor of the older group gives a "t" of 2.35 which is significant at approximately the .02 level. Thus, for the more educated the original trend indicating a decline in intelligence with age is completely reversed, and for those less well educated the original trend disappears. Apparently the decline in the older age groups resulted from the large number of low-education individuals in the population who are aged 55 or more.

In qualification of these results, two points must be made. There is no proof here that there is not a real decline in the very oldest groups such as those over 75. Unfortunately, the sample at

this level is too small to allow comparisons within educational groups. Secondly, the educational grouping is extremely gross. Within each category the older individuals do, in fact, have a lower educational level. This suggests that, if the sample were sufficiently large to allow finer classification and thus real matching on educational level, the superiority of the older subjects at the same educational level would be quite marked and probably would reach significance even in the lower educational groups. Although it is impossible to specify the exact shape of the curves of intellectual development, there is probably a rise for all educational groups with age that, after the termination of schooling, tends to be somewhat more marked in those with more education, but that never disappears even in those with practically no education. Certainly such a result might be expected if any sizable number of people with varying degrees of original education continue to be exposed to somewhat new environmental stimuli throughout their lives. Although for many it may be extremely difficult if not impossible to overcome an original educational deficit, and thus the lack of basic learning sets, it would appear that, within the limits set by prior educational accomplishments, increasing age does permit additional increments of exposure for these people, at least in spheres of primary importance such as the verbal.

The literature dealing with the relationship between age and intelligence is extensive. In a number of studies no attempt was made to control the education variable, although educational differences may be noted. McNemar (117) reports that for the Stanford-Binet standardization sample the scores on the Terman Vocabulary rose steadily from age 7 to 18. O'Connor (127) found a similar rise on his 150-item vocabulary test amounting to about five words a year from age 12 to 22 or 23. After that there is a steady, slow rise amounting to a total of ten words by the age of 50. Using the Wechsler-Bellevue Vocabulary on a sample of 1,000 white males aged 17 to 62, Lewinski (102) found a very slight rise in score that was reflected in a correlation coefficient of .17. As in the O'Connor sample, the number of cases at the upper age levels was quite small. Rabin (136) obtained essentially the same results from a state mental hospital population. The Thorndike-Gallup survey (172) produced some apparently contradictory evidence, however. They found that vocabulary score was relatively constant in the voting population up to the age of 50, but that

a drop did occur then, although it did not attain any sizable proportions below the over 60 group. Applying a vocabulary test as well as several performance tests to families borrowing from the Farm Security Administration in Maine, Ohio, and Missouri, Heston and Cannell (85) found a rise in vocabulary score to about the age of 55 after which there was a slight drop. The performance tests, with their large motor component, tend to start decreasing with age as early as 25, and with one test, the Knox Cubes, the drop occurred from age 15. Thorndike and Hagen (74) present some material on the relationship between age and intelligence in their field surveys. Vocabulary median score is lowest in the 18 through 25 group, rises to a peak in the 26 through 35 year olds, and then falls off. Arithmetic exhibits a similar pattern and so does mechanical ability, except that the lowest median is found among those over 45. To arrive at these figures, the 1950 Census Bureau data on education were used to correct the obtained values for inadequacies of the original sampling. Actually, the drop in score does not occur on any of the tests until the over 45 group, since the difference between 26 through 35 and 36 through 45 medians is 0.1 in all cases. Additional information is available based on the rather large-scale application of the Mill Hill Vocabulary Test in England. Foulds and Raven (59) and Raven (137) report a rise in score up to somewhere in the range between 25 and 30 years and then no change up to 55 or 60. Apparently, there is a drop in score for those below average somewhat prior to the age of 60, whereas for the more intelligent no drop at all is reported. In a study based on data collected between 1928 and 1933, Shakow and Goldman (141) found a rise in vocabulary score up to the age group 50 through 59, after which there was a decrease in score. The sample was selected to approximate the educational distribution in the population as a whole. Using a similar technique, in a study published in 1947, and comparing a 40 through 49 age group with one 70 through 79, Fox (60) found no reliable decrease in score for the older group. The younger group had a mean educational level of 10.7 years and the older one 7.7 years, but the groups had been matched on occupational level; this may have had the effect of selecting for intelligence within educational groupings.

These studies are in agreement that vocabulary score is either constant or increases slightly up to some point in the forties, but

do not agree as to the age at which a drop in score may occur. In fact, some studies suggest a steady rise in score throughout all age groups. Probably the differences are largely a function of the educational composition of the samples. Even when the samples are selected to represent the population figures for amount of education within age groups, differences will appear between studies to the extent the educational composition of the population has changed. The Shakow and Goldman data of the late 1920's are therefore, in no sense comparable to the Thorndike and Hagen figures for 1950.

In addition to the investigations reviewed already, there are several studies that compare age groups matched on educational level. Nyssen and Delys (126) report data for a sample of French-speaking Belgians matched on education, occupation, social class, and city size. The mean scores on a 50-item vocabulary test ranged from 29.7 in the 20 through 29 age group to 28.1 in the 50 through 59 group. The peak score occurred in the age group 30 through 34. No decline at all was found in the upper intelligence group, but among the less intelligent some drop did occur. The Weisenburg, Roe, and McBride (190) sample, although small, did have the advantage of almost equal educational composition at each age level; only the 20 through 29 group was slightly better educated than the others. On the Terman Vocabulary, mean scores rose from 52 in the 20 through 29 age group to 57 at age 30 through 39 and then stayed constant. The Thorndike Vocabulary rose from 53 in the 20 through 29 group to 73 in the 50 through 59 category and gives a significant correlation with age of .33. Thompson (167), in a fascinating study, tested 137 institutionalized morons whose original I. Q. ranged from 50 to 69. The matching was such as to insure that the results obtained would be a function of age. Although a marked decrease in performance test scores occurred in the decade 20 through 30, the Wechsler-Bellevue Vocabulary did not change. If anything, there was a slight rise in vocabulary with increasing age; but this did not appear to be reliable. In a study of university professors, Sward (156) compared a group ranging in age from 21 to 42 with an older group, over 60, on a number of tests. The younger professors were superior on all measures except a test of synonyms and antonyms, i.e., vocabulary. Many of the other tests were speeded, and, as Sward points out, the lower scores of the older group can be attributed to their

slow work and to a failure, for many years, to use the learning sets required by some of the tests. In another study of a superior group, Garfield and Blek (65) compared the vocabulary performance of three groups of teachers, a beginning group between the ages of 20 and 30 and averaging about 22, an experienced group between 40 and 50, and a sample of retired teachers between 60 and 70. All subjects were either college graduates or had had some college training, and all were unmarried women. The test scores rose from 31.3 in the youngest group, to 34.9 in the middle, to 37.6 in the retired, all differences being reliable.

Studies involving retests of subjects are limited, but some do exist. Owens (128) retested a group 31 years after the original testing on admission as freshmen to Iowa State University. The Army Alpha was used on both occasions. Increases occurred on total Alpha score and subtests measuring practical judgement, synonym-antonyms, disarranged sentences, information, and analogies. No change was found in following directions, arithmetical problems, and number series completion. There were no significant decreases on any subtests. Those with five years of college gained more than those with less then four years. These results are in essential agreement with data reported by Bayley (15) for a retest of the Terman gifted group with the Concept Mastery Test, composed of synonym-antonyms and analogies. The initial testing was in 1939-40 and the follow-up in 1950-52. The sample contained 768 gifted subjects and 335 husbands and wives of the gifted group, the average ages being 29 and 41 at the two testings. There was a sizable increase in score on both parts of the test, with only about nine per cent of the total group earning lower scores on the second administration. Grouping the subjects by five-year age intervals, gains were found at all ages from 20 to 50. The rise in score occurred at all educational levels, with the average gain being greater at the lower levels.

Taken as a whole these studies seem to imply that when disuse of learning sets is not an important factor, test scores may be expected to rise with increasing age. This appears to have been demonstrated rather conclusively for tests of verbal ability which tap a content area in which disuse is least likely. It seems highly probable that content areas other than the verbal will also be continually developed if they are used and if measurement is restricted to untimed tests of a primarily intellectual nature. These

conclusions raise the question of how much prior emphasis on the decline of intelligence with age, which now appears to be an artifact, has affected retirement policies and other administrative decisions which restrict the employability of older workers, especially at the highly skilled and skilled levels.

It appears that what has in many cases been taken for intellectual decline is a failure to perform rapidly. This may be due to a decrease in motor and perceptual speed and, thus, the rapidity of reading and writing answers or to a decrease in motivation to perform rapidly. In either case no decline in reasoning ability is involved. Christian and Patterson (39) administered a 120-word vocabulary test to a group of University of Minnesota freshmen and their relatives on a timed basis. They found a slight but insignificant drop in score with the older group. When the data were treated as a power test by using only the first 60 items which nearly all finished, there was a reliable increase in score with age. Similarly, Copeland (42) administered the Otis Test to subjects from 15 to 75 on a work-limit basis. Whereas the scores usually show a marked decline with age under the time-limit method of administration, no relation was found between accuracy and age. Lorge (106) matched three groups (aged 20 through 25, 27½ through 37½, and 40 to over 70) on the CAVD, a pure power test. When the Army Alpha and Otis, both timed, were administered to all subjects, there was a drop in test score with age.

A number of studies that involve the Wechsler-Bellevue Scale indicate how the non-intellectual factors in intelligence test performance may operate to suggest a decline in reasoning ability with age. Corsini (44) administered the Wechsler-Bellevue to all incoming prisoners at San Quentin and reports on a sample of 1,072 cases. He found a nine per cent rise in verbal ability with age, whereas the Wechsler standardization sample (188) showed an eight per cent drop. The performance tests tended to decline with age, especially Block Design, Picture Arrangement, and Digit Symbol. Corsini's data consistently support the hypothesis that tests heavily loaded with non-intellectual components such as speed, visual acuity, and motor performance will decline with age, while tests requiring continued intellectual learning will increase. Very similar results are reported by Berkowitz (18) for a sample of 1,233 subjects from the Bath, New York, Veterans Administration Center. As with the Corsini study, no matching

on education was carried out. Nevertheless, there was no drop with age on the Vocabulary and Information subtests, while Digit Symbol, Block Design, and Picture Arrangement decreased progressively. Other subtests showed varying amounts of decline, presumably in part as a function of educational differences, but in no case did the decline approximate that found for the three performance subtests.

Rural-Urban Residence

Table XII contains the results in terms of rural-urban residence. The differences tend to be quite small. Nevertheless, there is a clear-cut dichotomy: farm residents, those living in the country and in towns under 2,500 population, and residents of cities in the 50,000 to 500,000 range score reliably below residents of cities between 2,500 and 50,000 and over 500,000. To make these results

Table XII Intelligence of Various Rural-Urban Residence Groups

City Size	Mean	Standard Deviation	N
Farm	10.42	3.31	203
Less than 2,500	10.34	3.50	377
2,500 - 9,999	11.39	3.25	171
10,000 - 49,999	11.43	3.69	209
50,000 - 499,999	10.36	3.29	275
500,000 and above	11.09	3.47	265

t Values

	Less than 2,500	2,500-9,999	10,000-49,999	50,000-499,999	500,000 and above
Farm	.30	2.84	2.92	.20	2.11
Less than 2,500		3.31	3.54	.07	2.68
2,500 - 9,999			.11	3.23	.90
10,000 - 49,999				3.39	1.03
50,000 - 499,999					2.51

P Values

	Less than 2,500	2,500-9,999	10,000-49,999	50,000-499,999	500,000 and above
Farm	$>.10$	$<.01$	$<.01$	$>.10$	$<.05$
Less than 2,500		$<.001$	$<.001$	$>.10$	$<.01$
2,500 - 9,999			$>.10$	$<.01$	$>.10$
10,000 - 49,999				$<.001$	$>.10$
50,000 - 499,999					$<.02$

more meaningful, it might be helpful to note some representative cities in the three larger groups. The 10,000 through 49,999 category includes cities such as Beverly Hills, California; Waycross, Georgia; Fort Scott, Kansas; Bangor, Maine; Battle Creek, Michigan; Carlsbad, New Mexico; Endicott, New York; Bismarck, North Dakota; Sandusky, Ohio; and Brownsville, Texas. Into the 50,000 through 499,999 range fall Birmingham, Alabama; Denver, Colorado; Orlando, Florida; Peoria, Illinois; Worcester, Massachusetts; Omaha, Nebraska; Newark, New Jersey; Tulsa, Oklahoma; Memphis, Tennessee; and Seattle, Washington. Cities above 500,000 are Los Angeles, San Francisco, Chicago, New Orleans, Baltimore, Boston, Detroit, Minneapolis, St. Louis, Buffalo, New York City, Cincinnati, Cleveland, Philadelphia, Pittsburgh, Houston, Milwaukee, and Washington, D. C.

The drop in the cities of 50,000 to 500,000 population is somewhat surprising. Investigations in the past have generally indicated a rural-urban difference, as does the present study; but there has been practically no information on differences within the urban category. Terman and Merrill (164) report a difference of 6.5 I.Q. points, defining an area as urban if the population density is above 1,000 per square mile. Pintner (134), in an early review, mentions seven studies of elementary school children and four of high school students, all of which show differences of from four to eight I.Q. points in favor of the city groups. Shimberg (143) mentions school surveys in Virginia, North Carolina, Kentucky, New York, Indiana, Texas, Mississippi, and Pennsylvania, all of which report lower tests scores for rural children.

Some information provided by Bowerman (22) and derived from 1940 Census data is particularly relevant because of the marked relationship previously noted between intelligence and education. He found that the suburbs of large cities and college towns furnish nearly all the highest education areas. They fell, in general, in the population range 2,500 to 50,000 and coincided with the highest vocabulary means. Of the 613 cities with an average educational level above 10 years, only 19 were above 75,000 population and only one, Los Angeles, was above 500,000.

There has been some tendency to discount the rural-urban differential as a result of the inappropriateness of ordinary intelligence tests. This position was taken by Shimberg (142) who found that rural children did less well on an information test,

scaled on urban children, and urban children less well on a similar test, scaled on a rural group. The implication is that because of inferior schooling rural children do not have an equal opportunity on tests that emphasize academic content. Nevertheless, Nelson (125) found that among 1,061 freshmen at Washington State College, tested with the ACE Intelligence Test, those from rural areas did as well if not better than the urban group on arithmetic items, a content area which is almost wholly learned in school.

Even more striking evidence comes from a study done in Australia by Greenhalgh (73). He employed the results of the testing of all sixth graders in a large area to support his concept of talent erosion: the tendency for areas of population emigration to have low I.Q.'s and for those of immigration to have high I.Q.'s. He found that certain isolated rural sections had I.Q.'s that were not below the population average; the expected number of gifted children were found, apparently because no drain-off to areas of greater opportunity, primarily urban, had occurred. These results point to the fact that rural-urban groupings, such as I have employed, are meaningless for many purposes because they obscure and cancel out real differences that are a function not of the population density of areas but of opportunity and environmental stimulus potential. Unfortunately the present sample is much too small to attempt any mapping of the I.Q. distribution of the United States such as Greenhalgh was able to do for the specific area of Australia that he studied. Ginzberg and Bray (70) have presented such a map, county by county, for the World War II rejection rates for mental deficiency, leaving no doubt that many rural areas do have very low rejection rates.

While Greenhalgh places primary emphasis on selective migration, results obtained by Klineberg (96) with the National Intelligence Test suggest that the effects of a richer environment are marked. Among 12-year old Negroes tested in New Orleans, Atlanta, and Nashville, there was a rise from a score of 38.3 for those who had been in the city for one year to 68.7 for those living in the city for seven or more years. The native born group averaged 74.6. On the other hand, Gist and Clark (71) found in a study of 2,544 students, tested while in rural Kansas high schools, that those who had moved to urban centers during the succeeding 13 years were more intelligent than those who did not migrate or

those who migrated to other rural areas. Apparently, selective migration and the effects of an enriched environment are factors that must both be taken into account.

Geographical Area

Information on mean intelligence levels for different geographical areas is presented in Table XIII. Probably the most striking figure is the high value obtained for the Pacific Coast which is significantly superior to all other values, except those for the New England and Rocky Mountain States. The latter two areas, although averaging somewhat above the rest of the country, differentiate reliably only from the West Central States and the Deep South. The Middle Atlantic and East Central States fall into an intermediate position, below the Pacific Coast but above the West Central and Deep South Areas. The Border South can not be clearly placed, because it differs reliably only from the Pacific Coast. The lowest averages are those for the West Central States and the Deep South.

The results may be compared with the I.Q. conversions presented by Johnson (95) for the World War I data. He reports an average I.Q. of 104.5 for the Pacific Coast and Rocky Mountain States, 101.0 for the New England and Middle Atlantic Areas, 101.9 for the East Central States, 100.8 for the West Central States, and 93.9 for the Border and Deep South. The Thorndike and Gallup (172) voting sample results have also been converted by Johnson to standard score I.Q.'s, as follows: The Rocky Mountain and Pacific Coast vocabulary median of 12.30 gives an I.Q. of 104.3; the New England and Middle Atlantic States' value of 10.94 gives an I.Q. of 99.9; the East Central Area value of 10.75 gives an I.Q. of 98.9; the West Central States score 10.82 with an I.Q. of 99.6; the South scores 10.64 with an I.Q. of 98.6. The high figure for the South is probably due to the fact that a voting sample excludes many Southern Negroes.

There is reason to believe that educational differences are crucial in the high position enjoyed by the Pacific Coast and in the drop found for the Deep South. Bowerman (22) found that of the 613 cities with average educational level above 10 years in 1940, 79 were in California, and that Los Angeles was the only large industrial city to have this educational level. No Southern

TABLE XIII GEOGRAPHICAL DIFFERENCES IN INTELLIGENCE

Area	Mean	Standard Deviation	N
New England	11.14	3.39	96
Middle Atlantic	11.01	3.55	341
East Central	10.83	3.14	269
West Central	10.11	3.16	169
Border South	10.50	3.46	266
Deep South	9.85	3.67	154
Rocky Mountain	11.21	3.53	52
Pacific Coast	11.76	3.55	153

t Values

	Middle Atlantic	East Central	West Central	Border South	Deep South	Rocky Mountain	Pacific Coast
New England	.32	.81	2.48	1.56	2.77	.12	1.36
Middle Atlantic		.65	2.79	1.77	3.32	.38	2.17
East Central			2.32	1.15	2.90	.78	2.78
West Central				1.18	.68	2.12	4.40
Border South					1.81	1.34	3.55
Deep South						2.32	4.62
Rocky Mountain							.96

P Values

	Middle Atlantic	East Central	West Central	Border South	Deep South	Rocky Mountain	Pacific Coast
New England	>.10	>.10	<.02	>.10	<.01	>.10	>.10
Middle Atlantic		>.10	<.01	<.10	<.001	>.10	<.05
East Central			<.05	>.10	<.01	>.10	<.01
West Central				>.10	>.10	<.05	<.001
Border South					<.10	>.10	<.001
Deep South						<.05	<.001
Rocky Mountain							>.10

state except Texas, which is classified here as Border South, was in the top ten states on number of cities with a high educational level. Ginzberg and Bray (70) report that rejection rates for mental deficiency in World War II were almost ten times as high in the Southeast as in the Far West. The poor showing of the West Central States, however, does not appear to be primarily a function of educational differences. The states included (Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas) are characterized by their heavy emphasis on a farming economy. A check of the make-up of the West Central

States' sample indicates approximately a 10 per cent excess over the national average for number of farm residents. There is an 8 per cent reduction, from 12.2 per cent to 4.2 per cent, in the number of highly skilled workers versus a 6 per cent rise in the unskilled category. No other background factors suggest a reason for the lower average vocabulary score of the West Central Area.

In connection with the reduction in the number of highly skilled workers, some data reported by Thorndike (168) are interesting. He employed the information presented in the 1938 editions of Who's Who in America and American Men of Science and in the 1932 volume of Leaders in Education to compute the rank of the various states in terms of the number of superior men retained in the state as a proportion of the total population retained, the number of superior men attracted to the state as a proportion of the total attracted, and the number of superior men produced in comparison with total births. When these data are grouped by the geographical areas employed in this study, the West Central Area ranks third in proportion of superior men produced but eighth or last in proportion of such men retained, and sixth in proportion attracted. Whether or not this factor is still in operation today is, of course, unknown. The finding that the Pacific Coast ranks last in proportion of superior men attracted would probably not hold now. A heavy migration, however, continues from farms to urban areas. Since Gist and Clark (71) found in Kansas that emigrants from rural areas tended to be more intelligent than those who remained, it may well be that the West Central States do not hold the highly skilled workers whom they produce but keep many unskilled farm laborers who are essential to the agricultural economy.

Religion

The only reliable differences obtained between different religious denominations were those involving the Jewish group. A small number of Jews may be included in the other categories because they did not indicate a preference for the Jewish faith, but the religious preference question probably isolates the vast majority of Jews in the sample. The "Other" category is used to indicate a number of small religious groups, such as Greek Orthodox, Christian Science, Jehovah's Witnesses, Latter Day Saints, that are not properly classified as Protestant, Catholic, or Jewish,

TABLE XIV INTELLIGENCE OF RELIGIOUS GROUPS

Religion	Mean	Standard Deviation	N
Protestant	10.62	3.47	1121
Catholic	11.00	3.25	293
Jewish	12.71	3.51	49
Other	(10.64)	(3.82)	36

		t Values	
	Catholic	Jewish	Other
Protestant	1.69	4.12	.04
Catholic		3.36	.61
Jewish			2.56

		P Values	
	Catholic	Jewish	Other
Protestant	$<.10$	$<.001$	$>.10$
Catholic		$<.001$	$>.10$
Jewish			$<.02$

but none of which is well enough represented in the sample to be treated separately. The "Other" category also contains those who reported that they had no religious preference or were atheists (See Table XIV).

Most of the prior studies are based on quite limited populations. As might be expected, some studies will indicate a difference in favor of the Jewish sample, others in favor of the non-Jewish. Held (84) compared Jewish and gentile freshmen at the University of Pittsburgh in terms of their performance on the ACE Test and found a difference in favor of the former; this seemed to result from the particularly low mean for the gentile boys. Furthermore the differences were not found in the quantitative section of the test but only on the linguistic items. Clark (40), on the other hand, reporting on some 6,774 liberal arts freshmen admitted to Northwestern University between 1925 and 1941 had quite different results. Of 20 comparisons, based on different six-year groups and on scores from the ACE Test and the Ohio State University Psychological Examination, eleven favored the gentiles, eight the Jews, and there was one tie.

The more comprehensive studies seem to suggest that the Jewish group is somewhat more intelligent than the rest of the population. Terman and Oden (165) report that 10.41 per cent of the original gifted children (I.Q.'s of at least 135) were Jewish.

This figure is at least twice the national percentage. Within the gifted sample, there is no evidence that the Jews are more intelligent. There is also some data suggesting that among Jews mental deficiency is rather rare. Bailey (8) reports that, although 29.2 per cent of the volunteers and draftees in World War I were mentally deficient, only 17.2 per cent of the Jews were so classified. With the exception of the Scotch and Welsh, the Jewish group had the lowest mental deficiency rate of any "racial" group.

The localized studies present a conflicting picture. Pintner (134) in 1931 found that, of eleven studies of student groups, seven suggested a difference in favor of the Jewish children, three indicated non-Jewish superiority, and one found no difference. In 1936 Brill (26) reviewed essentially the same literature and found many of the studies methodologically unsound. The evidence seemed to suggest to him that Jews in the United States and Great Britain are probably superior or, at least, equal in intelligence to non-Jews of the same socio-economic status. At the college level, a majority of the studies indicated a higher level of intelligence among the Jews. In 1944, Klineberg (97) reported a median I.Q. of 103 for seven studies of Jewish groups and a range of 95 to 106 for the different investigations. (An I.Q. of 100 is assumed as the national average.)

One explanation of Jewish superiority is suggested by some figures compiled by Berdie (17). He reviewed several studies that indicate that a much higher percentage of Jewish high school graduates apply for college admission than do Protestants or Catholics. Probably the emphasis on education and professional work which is characteristic of the Jewish sub-culture does in fact act to increase the amount of education received and thus the amount of actual exposure. One might expect, therefore, a *superior development* of native potential, primarily as a result of the motivating effect of certain group values, rather than assume a *higher level* of native potential.

As a check on this hypothesis, the Jewish sample was compared with total sample frequencies on a number of background variables. The data on education are perhaps the most striking. Of those not in the student category, 73.2 per cent are high school graduates or above, compared with a total sample percentage of 39.4. Of the Jews, 19.5 per cent are college graduates, while 6.7 per cent of the total sample are in this category; 12.2 per cent of

the Jews had at least a year of college as compared with a sample figure of 6.9; 41.5 per cent of the Jews completed their education with high school graduation, a value 15.6 per cent above the total sample frequency.

In terms of the occupational classification system based on intelligence demand, the Jewish group, although somewhat above the rest of the total sample in percentage of highly skilled workers, is primarily concentrated in the skilled category at which 64 per cent are employed, while the estimate of the population figure is 31.7 per cent. None of the Jews are unskilled workers, and there are only about half the expected number of semi-skilled workers. The Jewish sample tends to be middle class, with a percentage of 61.2, as compared with 38.8 per cent reporting themselves as working class; the corresponding total sample figures are 38.6 per cent and 52.7 per cent. As might be expected, the Jewish sample derives primarily from large cities in the Middle Atlantic, East Central, and Pacific Coast Areas.

Since the sample is small, the results are not conclusive, but there is a strong suggestion that, since the Jewish culture acts to motivate its members toward increased actual exposure as a means to attaining higher level occupational positions, the increase in intelligence over that for other religious groups is largely a function of educational attainments.

CHAPTER 6

THE UTILIZATION OF INTELLECTUAL RESOURCES IN THE EDUCATIONAL SYSTEM

In this and the following chapter the results of the study are presented in an attempt to answer some of the questions that frequently arise concerning the utilization of intellectual resources in this country. In dealing with problems such as educational acceleration and enrichment, educational opportunity among different groups in the population, occupational opportunity, retirement policy, and possible methods of implementing the size of the labor force, I will try to make a clear distinction between factual data and personal opinion. The study as designed serves to pinpoint the areas and ways in which the intelligence of our population is being wasted and to indicate the extent of manpower wastage. The study does not provide information on specific methods that might be most efficiently and effectively used to achieve a better utilization of our intellectual resources. Instead it raises problems that were not known to exist, and casts new light on problems that were thought to be adequately solved.

The results also raise the problem of the desirability of change. In any given situation it may or may not be feasible to change the existing conditions in order to achieve better utilization of intellectual potential, depending on the effects such a change will probably have on other factors. For instance, in a factory there are a number of production workers whose intelligence is sufficiently high to warrant their promotion to a higher level job; the responsible administrator must decide not only how

to train these men and for what types of jobs but also what the effect of promoting them will be in terms of the total factory situation, including union conditions, the personalities of the men to be promoted, and plant morale. To take an extreme case, the promotion of a known and admitted communist in a defense industry might be undesirable on a number of counts such as national security, factory morale, and community relations, even if his intelligence were such as to warrant a higher level position. There is no doubt that the optimum utilization of our human resources is highly desirable, both as a means to raising our standards of living and as a contribution to national security. In any specific situation, however, local conditions have to be taken into account in evolving a methodology for change. Perhaps the most important factor is timing. A change that does not seem expedient today may well be quite feasible at some later date.

The data, to be presented in this and the following chapter, on educational and occupational manpower wastage are unique. A number of studies in the past have presented important information on the failure to utilize our intellectual resources that occurs because students leave the school system prior to reaching a level which would fully tax their intellectual abilities. This material has been combined by Wolfle (199) into estimates of the degree of student drop-out at different educational levels as related to intelligence. The present results, however, provide information not on school leavers but on those who are still in school. An attempt is made to determine the extent of the wastage that occurs due to our age-grade system of placement and the extent to which our students are intellectually capable of working on more difficult, more advanced subject matter. In addition, information is provided on the number of adults who could now profit from further education beyond that they received in their student days. The rationale for the use of a test of vocabulary in this connection has been developed in Chapter II. This rationale emphasized that the various educational levels require increasingly greater verbal ability and that, although various specific courses require other skills as well, vocabulary is the best predictor of the general level, within the school system, at which a given individual can perform adequately.

Intellectual ability, however, is never the only factor in school accomplishment. A student may have the intelligence for college

work but may not wish to go to college, or he may be the type of person who can not adjust to living away from his parents, assuming there is no college within commuting distance of his home. A grammar school pupil may have the intelligence for promotion to a grade above the one he is in but be unable to adjust emotionally to the fact of promotion or to his new peers. It is obvious that, unless some method is developed to overcome emotional problems and a lack of interest in school achievement, it will never be possible to attain full educational utilization of our intellectual resources. Furthermore, large segments of the population feel that such utilization is not even desirable. There are, as previously noted, differences in the value placed on education by different socio-economic and other groups in the population; and these values are extremely important in determining any individual's attitude toward educational achievement. Finally, external factors, such as illness or lack of adequate financial resources, may bar any given individual from achieving up to the level his intelligence would make possible.

It is important to keep in mind that the present computations are based on actual functioning level of intelligence. As more people are exposed to richer environments through better educational facilities and a higher standard of living (assuming that motivation to develop learning sets is present), the intelligence or reasoning ability of the population will increase. These changes will gradually invalidate the present results. We may expect a sizable rise in the measured intelligence of those people in the population who have high native potential but who, due to a lack of actual exposure (environmental stimulus potential and motivation), have not developed it. Unfortunately, techniques for measuring undeveloped native potential do not exist; accordingly no attempt has been made in this study to treat this group or to estimate its size. We are concerned only with the functioning verbal ability of the population and the extent to which it is a criterion of educational level.

Methodology

In order to establish the minimum intelligence required for performance at various educational levels, the total student sample, 251 cases in all, was first divided into three groups in

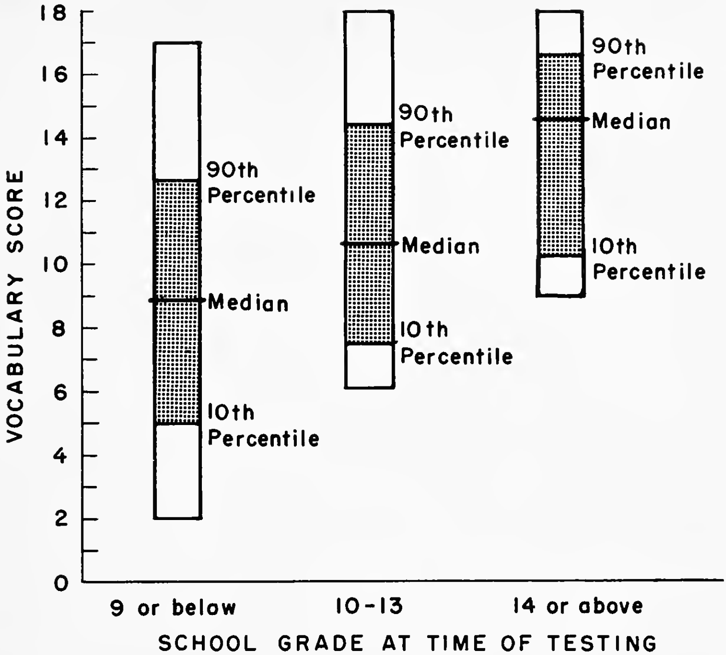

Fig. 4 Vocabulary Score Distributions for Different Grade Levels

accordance with the best available population estimates. The first group contained all students above the age of nine years who were in the ninth grade or a lower grade at the time of testing. Many of these had not actually started the grade they were in, since part of the testing was done prior to the beginning of the school year. The number of cases in this first group was 154. The second group, 74 in number, included all students either in or entering upon the tenth, eleventh, twelfth, and thirteenth grades, that is, all those in the last three years of high school or the first year of college. The final group, consisting of all those in the last three years of college or in graduate work, numbered only 23 and was supplemented by the addition of 31 cases that, although not a part of the basic sample of 1,500, were as a group not significantly different in either mean or standard deviation from the representative group of 23.

The distributions of vocabulary scores for these three groups are presented in Fig. 4, with the medians, 10th percentiles, 90th percentiles, and ranges indicated. In establishing minimum re-

quirements for performance at each educational level, the score directly above the 10th percentile point was chosen. Thus, a score of eight or better is requisite for performance in the last three years of high school or the first year of college, and a score of eleven or more at the level of a sophomore in college or above. A student scoring seven or below is considered capable only of grammar school or first year high school work; a student scoring eight, nine, or ten is considered capable of doing the work required in the last three years of high school and the first year of college, but no more; and the student scoring eleven or above is considered capable of doing the work at or above the sophomore year of college. Due to insufficient cases, it was impossible to separate out the graduate student group.

In using the 10th percentile point as a lower bound, a tendency to underestimate the number of students who could do more advanced work is introduced. The 10th percentile point, however, tends to be quite stable in successive sampling from the same population, whereas the lowest score tends to vary considerably. Since the samples employed vary in size, it was considered advisable to introduce a constant error producing conservative estimates throughout, rather than to allow random errors to operate in a totally unpredictable fashion. This procedure leads to small groups at the high school and college levels who score below the 10th percentile; they are, technically, performing at a higher level than their vocabulary score would warrant. In the following computations these individuals have been treated as if they were quite capable of doing the work at their present level. Thus, in a sense, the level for promotion is set above that required for continued performance, and the possibility of demotion is ruled out.

The Utilization of Student Intelligence

Employing the three educational levels in the manner indicated reveals that 54.6 per cent of all students are capable intellectually of doing work at a higher level. Of those in the ninth grade or below, who are over nine years of age, 30.5 per cent could be doing the work of at least a sophomore in college and another 34.4 per cent could handle the requirements for study somewhere in the 10th, 11th, 12th, or 13th grades. Exactly

TABLE XV UTILIZATION WITHIN THE SCHOOL SYSTEM

The reliability of association between background variables and intelligence to perform at a higher grade level.

Background Variable	d.f.	χ^2	P
Race	1	8.00	$<.01$
Class	3	2.14	$>.10$
Sex	1	0.00	$>.10$
Age	2	23.45	$<.001$
Rural-Urban Residence	5	3.75	$>.10$
Geographical Area	7	4.39	$>.10$
Religion	3	2.78	$>.10$

50 per cent of those who have completed a year or more of high school, but not a full year of college, could be sophomores in college or above. Stated somewhat differently, 40.6 per cent of all students 10 years of age and above are capable of working at the level of a college sophomore or above, although only 10.4 per cent are in fact studying at that level; 34.7 per cent are capable of doing the work required in the last three years of high school and the freshman year of college, while 30.3 per cent are in fact working in this range; and 24.7 per cent are capable only of work up to and including the first year of high school, whereas 59.4 per cent are so placed.

In order to determine whether any specific groups in the population have a large number of members capable of doing the work at a higher grade level, several background variables were tested for an association with underplacement in the school system. The results are presented in Table XV. The chi-square values were obtained by dividing the total number of students possessing the characteristics for each category into those intellectually capable and those not capable of performance above their present level. Then a two by x chi-square was computed in which x equals the number of categories into which the background variable has been divided. Of the variables tested, only race and age are reliably associated with underplacement.

In comparison with the percentage of 54.6 for all students who are working at a level below that of which they are intellectually capable, 65.3 per cent of the 10 through 13 year olds, 53.2 per cent of the 14 through 17 year olds, and 18.2 per cent

of those 18 and older are underplaced. Applying the chi-square technique with one degree of freedom to the individual comparisons indicates that the difference between the 10 through 13 and 18 and over groups is reliable ($\chi^2 = 21.63$, $P < .001$) as is that between the 14 through 17 and 18 and over groups ($\chi^2 = 10.89$, $P < .001$). The 10 through 13 year olds and the 14 through 17 year olds do not differ significantly.

Apparently most of those 18 years of age and older, who are still in school, are working at a level commensurate with their abilities. Many of them are in the last three years of college or graduate school. Thus, they can not be underplaced without the addition of a level above them. The figure of 18.2 per cent is, in one sense, an artifact of the way underplacement is defined. Nevertheless, some level of education has to be established as the top, and it seems reasonable that underplacement for an advanced college student is impossible. In this older group, high school students and college freshmen are the primary contributors to the relatively small amount of underplacement. In comparison with these older students, the amount of wastage of intellectual potential at the lower levels, at which compulsory school attendance prevails, is sizable.

The findings on racial differences are that 57.3 per cent of the whites are capable of higher level school performance, while only 21.1 per cent of the Negroes fall into this category. It appears that the school system is more nearly geared to the Negro intelligence than that of the whites. When promotion depends primarily on age, as it does in American schools, the minimum intellectual demand for each level is set at the score that represents the least intelligent individuals in the corresponding age group. Since the Negroes as a group tend to obtain consistently lower scores on intelligence tests than whites, they will, presumably, bunch nearer the 10th percentile point at each level and may well be an important element in the fixing of the lower bound. Whites as a group will score somewhat above the median for each educational level. Because of this relative distribution of white and Negro intelligence within each educational category, fewer Negroes will fall above the minimum intelligence required for the next higher category. The reduction in underplacement among Negroes is also related to the fact that the

standard deviation of Negro intelligence scores is reliably smaller than that of whites. The reduced variability makes it less probable that any given Negro student will score above the 10th percentile point of the next higher educational level. The racial difference found is largely the result of our philosophy of education that favors age rather than performance as a basis for promotion, combined with whatever conditions may operate to restrict Negroes as a group to a relatively low intellectual level.

The over-all picture shows a marked wastage of intellectual ability within the school system, especially at the grammar school and high school levels. The majority of students are working at a level at least four grades below that at which they could be working. If this situation is to be changed, it will require a combination of rapid promotion and increased difficulty of the material taught at each level. Leaving the intellectual demand unchanged, while promoting students as rapidly as possible, would result in there being more students in college than in the last four years of grade school. At the other extreme, if difficulty levels were upgraded sharply, without rapid promotion, a reduction of the numbers of students at the upper levels would occur, with a consequent reduction in the total number of students. Many students would find that, once they reached high school, they had "gone as far as they could go," and they would have to enter the labor force. If increased difficulty level and promotion are combined, it will become necessary to demote those who have attained higher levels but can not handle the more difficult material, or else these individuals will be forced to seek employment. With demotions, school enrollments will remain essentially the same; without them, there will be a reduction of the number of students at the lower levels and thus of the total number.

The picture is further complicated by the possibility of using enrichment procedures that eliminate the concept of grade levels as presently employed. By teaching the more advanced students in each grade somewhat more complex material, it is possible to enrich their educational experience without rapid promotion. Such a procedure may call for special sections of classes or may involve special assignments within a single class; it voids the assumption that one fifth grader knows the same subject matter

as another. The possible courses of action are many. The problem is made even more complex by the nature of physical plants, proliferated administrative control, problems of teacher training, and local biases. Certainly change can not be expected to occur rapidly.

Some efforts, however, have already been made. The U.S. Office of Education reports that 4,080 elementary school pupils and 16,632 secondary school students were being taught, in 1948, in special classes for the gifted. Witty (198) reports that in the state of Ohio enrichment is a regular part of the school program in nine per cent of the 258 schools contacted in one survey. Special classes are employed rather extensively in New York City. The private schools are carrying on an extensive program for the education of superior students in an enriched environment. Miles (118) notes that the rate of learning in private schools is 15 to 20 per cent faster than in the average public elementary school. Students in private schools tend to be sufficiently intelligent, approximately 90 per cent being average or above, to take advantage of the enrichment.

Several studies deal with the emotional adjustment of children who are rapidly accelerated in school. Zorbaugh, Boardman, and Sheldon (203) found that in New York City the accelerated gifted child is apt to be out of place socially and that emotional problems are frequent. On the other hand, a recent report of the Ford Fund for the Advancement of Education, on their program of educational acceleration (24), indicates that students who are allowed to enter college one or even two years before the time of high school graduation are, as a group, as well adjusted socially as those who follow the conventional progression. Terman and Oden (166) compared those of their gifted group who were accelerated and those who were not, using a variety of indices of social and emotional adjustment, and found no evidence for a difference between the two groups. Apparently, acceleration per se does not produce maladjustment; but the gifted child, if thrown alone with an older group, may have some real difficulty. The very fact that over 50 per cent of all school children are underplaced should provide a solution to this problem. If acceleration is employed, it will be a matter not of individuals but of sizable groups being shifted upward.

The Utilization of Adult Potential

Using the minimum intellectual demand scores for the various educational levels established in the analysis of the student data, it is possible to determine how many of the non-student population could attain a higher educational level if they returned to school now. Since the results are in part a function of the changes in intellectual ability that have occurred after the individual left school, they can not be used as an index of the wastage of intellectual resources that occurs because the individual has left school prior to reaching the highest level warranted by his intelligence. Such a figure could be computed only from tests administered at or near the time of leaving school.

Of the non-student population including the employed, retired, unemployed, and housewives, 57.8 per cent are now capable of attaining a higher level in terms of the three educational strata previously defined. Of those who completed eight grades or less, 37 per cent have the intelligence now to work in the 10th, 11th, 12th, or 13th grades, while 31.3 per cent are intellectually capable of meeting the standards for study in the last three years of college or at the graduate level. Among those with nine through twelve years of education, 65.6 per cent are sufficiently intelligent to work at this uppermost level.

As with the students, it is possible to determine whether an association exists between background variables and the potentiality for higher educational achievement. This information is summarized in Table XVI. Not only do race and age continue to be important variables, but occupation, class, and city size also emerge as reliably related to the capacity for more education.

Of the background variables in Table XVI, the one showing the most striking association with capacity for more education is the occupational classification system devised to reflect intelligence demand. The result derives entirely from the rather low percentage found for the highly skilled group. Whereas only 20.9 per cent of the highly skilled are capable of a higher educational level, 63.1 per cent of the skilled, 60.5 per cent of the semi-skilled, and 52.3 per cent of the unskilled have such potential. The latter three values differ from that for the highly skilled with chi-squares of 45.43, 41.63, and 20.89. All are reliable beyond the .001 probability level. This probably reflects the fact that the

TABLE XVI EDUCATIONAL UTILIZATION AMONG NON-STUDENTS

The reliability of association between background variables and intelligence to achieve a higher educational level.

Background Variable	d.f.	χ^2	P
Occupation (Employed only)	3	52.96	<.001
Race	1	5.79	<.02
Class	3	28.99	<.001
Sex	1	2.66	>.10
Age	6	25.75	<.001
Rural-Urban Residence	5	11.69	<.05
Geographical Area	7	10.29	>.10
Religion	3	5.66	>.10

highly skilled occupations tend to require college training, while the other occupational levels are much less dependent on a specific educational level for adequate performance. The great majority of highly skilled workers have reached a point very near the top of the educational system and are by definition unable to achieve a higher educational level irrespective of their intelligence.

Racial differences are similar to those obtained with the students but not nearly as large. Fifty-nine per cent of the whites and 47.8 per cent of the Negroes are capable of more education. The Negroes, in spite of the fact that their educational level tends to be below that of the white group, are somewhat less likely to be capable of doing the work at a level which is more advanced than that they have already achieved.

With regard to subjective class identification, 29 per cent of the upper class are capable of more education, 51.9 per cent of the middle class, 63.4 per cent of the working class, and 50.0 per cent of the lower class. The upper class group numbers only 31 cases, but it differs reliably from the middle class ($\chi^2 = 5.15$, $P<.05$) and from the working class ($\chi^2 = 13.43$, $P<.001$). The middle-working class difference is reliable with a chi-square of 14.31 ($P<.001$). The lower class does not differ reliably from any other group. In evaluating the upper class figure, it should be kept in mind that this group is highly heterogeneous in its vocabulary score and that the mean for the group is significantly below that for the middle class. Nevertheless, the results are in

agreement with the expectation that the higher an individual's social class the more likely he is, in terms of motivation and financial requirements, to stay in school until he has reached a level at which he can no longer do the work or until he attains the top level. The lower class sample does not act in accordance with this hypothesis; it is heavily weighted with Negroes, and this may account for its position relative to the other social classes. The results probably can not be explained in terms of differential increase in intelligence after leaving school, as this would require that members of the two higher classes be less likely to develop new learning sets. Such a conclusion is inconsistent with prior findings to the effect that social class and educational level have a high positive correlation and that the rise in intelligence, over time, is greater in those with more education.

As with the students, there is an association between age and capability for higher level achievement. In the non-students, however, the relationship is reversed. In the 14 through 24 age group 43.8 per cent could do the work at a higher educational level if they returned to school; in the 25 through 34 year olds the figure is 52.2 per cent; in the 35 through 44 year olds 60.6 per cent; in the 45 through 54 year olds 60.3 per cent; in the 55 through 64 year olds 64.6 per cent; and in those 65 and over 66.2 per cent. Applying the chi-square technique to these differences reveals that the 14 through 24 group is reliably below four other age groups, namely, the 35 through 44 with $\chi^2 = 10.11$ ($P < .01$), the 45 through 54 with $\chi^2 = 8.87$ ($P < .01$), the 55 through 64 with $\chi^2 = 13.00$ ($P < .001$), and the 65 and over with $\chi^2 = 14.57$ ($P < .001$). The 25 through 34 group also seems to be low, since it differs at beyond the .02 probability level ($\chi^2 = 6.22$) from the 55 through 64 year olds and at beyond the .01 level ($\chi^2 = 7.54$) from those 65 and over. Although for the purpose of computing the reliability of group differences it was necessary to combine the 14 through 17 and 18 through 24 groups, because of the very small number of cases in the youngest category, the potentiality for more education is present in 31.3 per cent of this youngest group of non-students. While it is impossible to specify with a high degree of certainty the reason for reduced percentages in the younger groups, it may be that the intelligence

of the older people has increased more since they left school and that, accordingly, there are more of them who are now capable of increasing their educational level than there were at the time of school leaving. On the other hand, with advances in the educational level of the population in recent years, more students probably have been going as far in the educational system as their intelligence would allow.

The remaining variable, rural-urban residence, does not show a highly reliable association with potential for more schooling. Significance is obtained primarily because of the rather low percentage, 49.8, found in the 50,000 through 499,999 group. This value differs with a chi-square of 4.10 ($P<.05$) from the 60.6 per cent found among farm residents; with a chi-square of 5.00 ($P<.05$) from the 59.7 per cent found in those living in the country (but not on farms) or in towns of less than 2,500; and with a chi-square of 9.27 ($P<.01$) from the 66.4 per cent found in the 2,500 through 9,999 group. The percentages of 56.8 associated with the 10,000 through 49,999 group and of 56.6 associated with the over 500,000 group do not differ reliably from any other values. Apparently, there is a slight increase in the rural regions and in small cities in the percentage of people capable of more education. In the cities with a population of 50,000 through 499,999, on the other hand, there is some decrease in the percentage. Neither of these trends reaches large proportions.

Studies of School Leaving

In order to supplement the more general results on capacity for further education, the available evidence on the intelligence of school leavers will be discussed, with a view to determining the wastage that occurs at the time of leaving the educational system. Although the data are far from complete, they do permit statements independent of the effects of intellectual change with age and thus give a more precise estimate of how many students actually leave school at a level below that which they could attain.

Perhaps the most comprehensive data come from the World War II testing with the AGCT, reported by Bingham (20). Although this sample includes many who had been out of school for some time as well as many whose education was interrupted by war, the results are still of rather general interest. Of those

scoring in Grade I, the top 5.8 per cent, only one-fourth were college graduates. In Grade II, the next 26.2 per cent of the intelligence distribution, approximately 7 per cent were college graduates; 60 per cent had finished high school but not college; 31 per cent had completed grammar school but not high school; and 2 per cent did not finish the eighth grade. Directly commissioned officers are not included in these figures; the majority of these were college graduates of rather high intelligence.

Wolfle (199) recently pooled the results of the studies of the Commission on Human Resources and Advanced Training to derive a series of estimates of the percentage of those with different AGCT scores who attain different educational levels. He finds, for instance, that of those scoring in the range 73-77 on the AGCT, 50 per cent enter high school, 16.0 per cent graduate, 2.0 per cent enter college, and .2 per cent graduate; in the range 103-107, 89.6 per cent enter high school, 70.3 per cent graduate, 22.6 per cent enter college, and 10.5 per cent graduate; in the range 123-127, 98.2 per cent enter high school, 92.8 per cent graduate, 41.7 per cent enter college, and 31.6 per cent graduate; in the range 143-147, 99.8 per cent enter high school, 98.7 per cent graduate, 56.9 per cent enter college, and 53.2 per cent graduate; and above 163, 100.0 per cent enter high school, 99.5 per cent graduate, 70.0 per cent enter college, and 69.1 per cent graduate. Thus, even at the very highest levels, 30 per cent are not entering college. These figures suggest that the Terman (165) gifted group is somewhat atypical in that approximately 68 per cent graduated from college and another 14 per cent started college but did not finish.

Among the local studies that have dealt with the drop-out between high school and college, there is one study, conducted by Dillon (50) on a sample of children leaving school between the seventh and twelfth grades, that indicates some wastage even at this level. Five areas, primarily urban, in Michigan, Ohio, and Indiana were studied. Of those leaving school, 5 per cent had an I.Q. of 114 or more, 12 per cent scored in the 105-113 range, 22 per cent between 95 and 105, and 61 per cent below 95.

A number of estimates, based on varied sets of data, have been made of the extent to which manpower is wasted at the college level. Havighurst (80) suggests that 40 to 45 per cent of the top fifth (in intelligence) of the population of college age

now go to college. The National Manpower Council (123), using information provided by the Commission on Human Resources and Advanced Training, estimates that about 46 per cent of those with AGCT scores of above 120 (the top 16 per cent) enter college, and 37 per cent graduate. Hollinshead (87), employing the top quarter of the population as the base, indicates that slightly under 40 per cent graduate from high school and go to college, slightly over 40 per cent are high school graduates but do not go to college, and slightly under 20 per cent do not graduate from high school.

Several estimates are based on studies furnishing information on rather circumscribed geographic areas that are in no case larger than a whole state. Thus, Learned and Wood (99) found in Pennslyvania that over 25 per cent of the non-college high school graduates scored above the median for those who went to college. Among the 2,616 Iowa high school graduates reported on by Phearman (131), 32 per cent of the boys and 40 per cent of the girls in the top 9 per cent in intelligence did not go to college. Berdie (17) found in Minnesota that among high school graduates with an I.Q. of 120 or higher (the top 18 per cent) 26 per cent of the boys and 38 per cent of the girls were not planning on college. White (196), using information gathered in the Cleveland-Akron-Lorain area of Ohio, found that 43 per cent of those with I.Q.'s of 116 or higher had not enrolled in college 15 months after high school graduation. Only 11.8 per cent of these came from the upper and upper middle classes, while 32.3 per cent were lower middle class and 55.9 per cent upper lower and lower lower class.

The Method Applied to Intelligence-Grade Placement

When methods that might be employed to overcome the lack of correspondence between intelligence and grade level were discussed, one possible solution mentioned was the combining of rapid promotion and increased difficulty level. Such a procedure would suggest the use of verbal ability rather than age as a primary criterion for grade placement, with the most intelligent students being advanced rapidly to the top level and the difficulty of the material increased to a degree commensurate with the raised intellectual level. If the educational facilities were to remain constant in size, it would be necessary to demote the same

number of students as were promoted, the degree of demotion being a function of the student's intelligence.

In order to determine how far the present system of grade placement, based as it is on age and school marks, deviates from placement based on verbal ability alone, it is necessary to set up a system of vocabulary score ranges similar to those employed to estimate the number of students capable of doing the work at a higher level. This may be accomplished by counting down the distribution of student scores until a point is reached that marks the lower bound of the college sophomore and above group. Since in the sample the number of students at each level is derived from the best available census data on school and college enrollments, the figure of 23 for the number of students in the last three years of college and graduate work represents the present physical capacity of our colleges and graduate schools. If, then, all students with vocabulary scores of 15 or more were placed at this top educational level, the facilities would be filled to roughly the same extent as at present; obviously, many students presently at lower levels would have to be promoted and an equal number at higher levels demoted. Similarly, for the next lower level, counting down an additional 74 cases establishes the vocabulary range from 11 through 14 as the one that would indicate placement in the tenth, eleventh, twelfth, or thirteenth grades. If all students with this degree of verbal ability were placed at this educational level, the educational facilities presently available would be exhausted. Finally, a score of 10 or below may be established as indicating placement within the first nine grades, if verbal ability is the only criterion.

This procedure sets up much more stringent intellectual demands for the two higher levels than presently exist. The groups are made as intellectually homogeneous as possible with all overlap eliminated. Since the variability of intelligence at each level is markedly reduced, the material taught in high school and college can be much more difficult than is now possible. The lower bound for the top level rises from the present score of 11 to 15; for the middle group the rise is from 8 to 11. By comparing each student's present grade placement with that indicated for his vocabulary score, it is possible to determine whether he would be capable of doing the more difficult work which would be required at his present level, whether he could be promoted to an

even higher level, or whether he might best be demoted to a lower level. Frequencies may then be obtained for the number whose present grade placement is above or below that which would be required under an intelligence-grade system, and these frequencies may be considered as measures of the degree to which our present placement procedures deviate from one based on verbal ability alone. Thus, it is possible to determine how much of a change would be required to shift over to this new method of placement.

Intelligence-Grade Placement of Students

Since the standards set for performance at the two upper levels are well above those that result from the present placement system, and since the number capable of working at each level is restricted by the size of available facilities, the deviation from a perfect intelligence-grade placement system is not as large as that found when actual intelligence demand under an age-grade system is employed as the basis for comparison. Only about 21.5 per cent of all students would have to be promoted and essentially the same number demoted to reorient the school system along intelligence lines. Of those who have completed no grade above the eighth, only 3.9 per cent would have to be promoted to the level of sophomore in college or above, while another 26.6 per cent of the grammar school group would require a shift to the tenth, eleventh, twelfth, or thirteenth grade. Of this middle group, 9.5 per cent would have to be placed in college above the freshman level. On the demotion side, the results are more striking. In order to keep enrollment constant and make the promotions indicated, 21.7 per cent of the college group (not including freshmen) would have to be demoted to the ninth grade or below and an equal number, 21.7 per cent, would require a shift into the last three years of high school or the first year of college. In addition, exactly half of those presently in the range tenth grade through freshman in college would have to be demoted to the level of high school freshmen or below. Disregarding rounding errors, the number of students to be promoted and demoted is the same, but the percentage figures are derived from basic groups of different sizes and therefore are not necessarily identical.

TABLE XVII STUDENT UTILIZATION AND AN INTELLIGENCE-GRADE SYSTEM: PROMOTION

The reliability of association between background variables and intelligence to perform at a higher grade level under an intelligence-grade system.

Background Variable	d.f.	χ^2	P
Race	1	2.28	$>.10$
Class	3	.24	$>.10$
Sex	1	1.39	$>.10$
Age	2	7.46	$<.05$
Rural-Urban Residence	5	5.15	$>.10$
Geographical Area	7	9.59	$>.10$
Religion	3	.47	$>.10$

TABLE XVIII STUDENT UTILIZATION AND AN INTELLIGENCE-GRADE SYSTEM: DEMOTION

The reliability of association between background variables and intelligence to perform only at a lower grade level under an intelligence-grade system.

Background Variable	d.f.	χ^2	P
Race	1	.05	$>.10$
Class	3	3.15	$>.10$
Sex	1	4.10	$<.05$
Age	2	52.82	$<.001$
Rural-Urban Residence	5	3.29	$>.10$
Geographical Area	7	4.34	$>.10$
Religion	3	3.74	$>.10$

It is also possible to determine, with the procedure previously employed, what groups in the population would be most affected by such a readjustment of the educational system. Tables XVII and XVIII list the results of an analysis of the background variables that are associated with the promotion requirement and with the demotion requirement. As might be expected, age seems to be associated with both types of shift. Sex is related to the demotion requirement.

The data indicate that promotion would be most frequently required at the lowest age level. In the 10 through 13 range, 29.8 per cent would have to be promoted, while at 14 through 17 years of age the figure would be only 13.8 per cent; and above the age of 18 it would be 12.1 per cent. Of these differences only that between the 10 through 13 and 14 through 17 groups is reliable

($\chi^2 = 6.95$, $P < .01$). The 18 and above group, of only 33 cases, does not furnish a significant difference. Demotion appears to be required almost entirely in the two older groups. Only 0.8 per cent of the 10 through 13 year olds would have to be demoted as compared with 34.0 per cent of the 14 through 17 year olds and 42.4 per cent of those 18 and over. Although the latter two groups do not differ from each other reliably, the difference between the 14 through 17 group and the youngest children yields a chi-square of 43.01 ($P < .001$) and that between the 18 and over group and the youngest a chi-square of 46.65 ($P < .001$).

The finding that more girls than boys would have to be demoted is rather surprising. The figures are 25.0 per cent for girls and 14.1 per cent for boys. It appears probable that girls are promoted more frequently than boys in today's school system, that they are given higher marks than boys throughout grade school and high school, in particular, and that they are more likely to skip a grade while the boys are somewhat more likely to be dropped back a grade. If this is the case and the sexes are equal in verbal ability, it would account for the present result. Actually, Berdie (17) has found that in Minnesota the mean high school percentile rank for boys is 44.68, while for girls it is 57.46. This difference is found in all rural-urban groups and in all groupings based on plans after high school graduation. Apparently either teachers have a bias in favor of girl students or the girls, in fact, do better work because of a higher motivation for school achievement.

Adult Potential under Intelligence-Grade Placement

The final question with regard to education that may be answered from the data concerns the number of non-students who could presumably return to school at a higher educational level if the change to an intelligence-grade system were made. The numbers are smaller than those obtained when the comparison is made against present actual intelligence demands for performance at the different levels. Approximately 19.8 per cent of all non-students could presumably perform at a higher educational level if they returned to schools that based placement on verbal ability. Of those who previously completed eight years or less of schooling, 5.8 per cent have the potential for work in the last three years of college or at the graduate level, and 25.5

TABLE XIX NON-STUDENT UTILIZATION AND AN INTELLIGENCE-GRADE SYSTEM

The reliability of association between background variables and intelligence to achieve a higher educational level under an intelligence-grade system.

Background Variable	d.f	χ^2	P
Occupation (Employed only)	3	7.57	$<.10$
Race	1	14.93	$<.001$
Class	3	4.40	$>.10$
Sex	1	.73	$>.10$
Age	6	57.08	$<.001$
Rural-Urban Residence	5	12.98	$<.05$
Geographical Area	7	12.72	$<.10$
Religion	3	2.84	$<.10$

per cent would be capable of tenth, eleventh, twelfth, or thirteenth grade work. In addition, 15.1 per cent of those who completed a grade or more in high school or who started but did not complete the freshman year of college could perform at the highest level under a placement system and difficulty standard changed to conform with intelligence only.

In Table XIX the data on association between background variables and potentiality for increased education under the revised placement system are presented. Reliable associations are found for race, age, and rural-urban residence, while occupation and class no longer appear as significant variables. Race continues to be an important variable with 21.2 per cent of the whites and only 8.2 per cent of the Negroes capable of performance at a higher educational level under a revised system. There are apparently very few Negroes who left school at an educational level markedly below that which they might have attained.

As to age, the differences are quite striking. From a percentage of 6.8 at age 14 through 24, the figures rise steadily to 12.9 at age 25 through 34, 17.1 at 35 through 44, 24.2 at 45 through 54, 26.3 at 55 through 64, and finally jump to 35.7 at age 65 and above. The 14 through 24 age group differs reliably from all groups above 35 years, with chi-square values of 7.66 ($P<.01$), 17.28 ($P<.001$), 19.63 ($P<.001$), and 35.20 ($P<.001$) for comparisons with each successively higher age group. Simi-

larly, the frequency in the 25 through 34 age group is significantly below that in all groups above 45, with chi-squares of 9.82 ($P<.01$), 11.97 ($P<.001$), and 29.73 ($P<.001$), respectively. The 35 through 44 year olds differ from those 55 through 64 at beyond the .05 level of significance ($\chi^2 = 4.86$) and from those 65 and over at beyond the .001 level ($\chi^2 = 17.75$). A chi-square of 5.31 ($P<.05$) is obtained for the 45 through 54 versus 65 and over comparison. As previously noted, the effect of age, which is even more prominent here than in the comparison with actual intelligence demands, is presumably in part a result of increasing verbal ability at each higher age level and in part of the steadily increasing average level of education of each succeeding generation. It appears that most young people today reach an educational level commensurate with their intellectual potential so that they could not return to school at a higher level under a placement system employing an intelligence-grade criterion. They could, however, benefit from further schooling at essentially the level at which they left school because the material offered at that level would be more advanced.

The rural-urban differences appear between the largest cities and the rural regions. While 26.1 per cent of farm residents could return to school at a higher level, even with the conversion to an intelligence-grade system, only 15.2 per cent of those in cities of 50,000 through 499,999 could do so ($\chi^2 = 6.90$, $P<.01$), and only 14.9 per cent of the residents of cities of 500,000 or over ($\chi^2 = 6.55$, $P<.02$). Similarly, 22.4 per cent of those who live in the country (but not on farms) or in cities of less than 2,500 could return, a figure that differs at beyond the .05 level from the two large city groups with chi-squares of 4.26 and 4.00, respectively. The two smaller city groups produce percentages of 23.1 and 18.9 for the 2,500 through 9,999 and 10,000 through 49,999 population categories. Neither of these values differs reliably from any other. Again, a trend is apparent in the data that was present in the computations based on intelligence demands at the present time. This is quite consistent with expectations, because rural areas tend to put less of a premium on higher education than cities. With the added fact that colleges are not nearly as available to rural students as to those in cities, it is not surprising that many rural residents do not even approximate the educational level they could attain.

THE LABOR FORCE AND MANPOWER UTILIZATION

Since the end of World War II, a number of social scientists have dealt with the problem of manpower wastage as it relates to the placement of individuals in the occupational hierarchy. They have pointed to the large range of intelligence found within different occupations and have emphasized the need for a more efficient utilization of our human resources. Although the problems involved in reorganizing the occupational structure are many and complex, it has been argued that they must be solved if we are to maintain our competitive position on the international scene.

One of the earliest papers on this subject was published by Bingham (20) at the end of World War II. He pointed out that, based on AGCT results, the upper one-fourth of the heavy truck drivers in civilian life were more intelligent than the lower one-fourth of the managers and officials. Although lawyers were near the top of the professions in intelligence, nine per cent of the boilermakers scored as high as the average lawyer.

These results were supplemented the following year by Stewart's (153) extensive study of the AGCT scores associated with the various civilian occupations of Army personnel. Again, the overlap between low and high level occupations was found to be sizable. The two extreme groups, accountants and lumberjacks, were not mutually exclusive with regard to intelligence, the top 10 per cent of the lumberjacks being above the accountants' 10th percentile point. Similarly, 10 per cent of all farm laborers were above the median for geologists, and 10 per cent of the con-

struction foremen above the median for medical students. The study showed 25 per cent of the structural steel workers scoring above the median for the bookkeeping-machine operators, and 50 per cent of the railroad laborers above the 10th percentile of the purchasing agents.

In a study of the intelligence of the employees and executives of a photographic manufacturing plant, Foulds and Raven (58) found that the vocabulary scores of 11 per cent of the unskilled and 16 per cent of the semi-skilled workers fell in the highest quartile along with 79 per cent of the executives. Simon and Levitt (144) found in their study of 1,753 people from the New York City area, tested with the Wechsler-Bellevue, that 10 per cent of the personal service group, including waitresses, soda fountain attendants, domestics, etc., scored above the 10th percentile of the engineers, while 50 per cent of the skilled laborers, such as machinists, electricians, plumbers, were more intelligent than the lowest 10 per cent of the teachers.

None of these authors suggests that all of those who have the intelligence for higher level positions would necessarily function successfully if promoted. Many workers might well be unable to stand the increased emotional strain of higher level positions and would develop incapacitating symptoms if placed in jobs commensurate with their intelligence. Furthermore, there are people to whom higher level positions are for one reason or another unappealing. Added responsibility or the necessity for a long period of training makes professional and managerial positions quite undesirable for many people. Similarly, many an unskilled worker would not be willing to forego working outdoors to get a job at the semi-skilled level in the factory. Thus, personality factors, interests, and attitudes limit the extent to which intellectual resources can be utilized.

In addition, class attitudes tend to keep many intelligent people from attaining the educational level required for the higher positions. Financial factors are frequently important in restricting training. Probably most important is the fact that the working class member, even if very intelligent, may not realize that he is capable of attaining a professional or managerial position; even the skilled occupations seem foreign and distant to many. For an individual who has very little understanding of the nature of higher level positions and who has met and talked with few if any

people who are employed as lawyers, teachers, production managers, etc., the probability of wishing to achieve this level is very remote indeed. In the over-all picture, therefore, the really important thing appears, again, to be motivation.

As in the analysis of the educational system, the vocabulary test results may be used to determine the extent to which workers are employed in positions below the level of which they are intellectually capable. This approach does not, as pointed out in Chapter II, deny the value of special abilities other than the verbal but it assumes that each higher occupational level requires a certain increment in verbal ability. Within any given level there are a variety of specific types of jobs that may require varied intellectual abilities as well as other types of skills. At the skilled level, a person with a high degree of dexterity might become an engraver; one with ability to supervise others, a foreman; one with mechanical ability, an aircraft engine mechanic; one with musical ability, a professional singer; one with numerical skill, a bookkeeper; and one with high social skills, a welcome wagon hostess. In all of these positions, however, a certain minimum of verbal ability is essential. Vocabulary, therefore, may be used to estimate the level at which an individual is capable of working; but on this level he would do well to select a specific job utilizing whatever special abilities he might have developed.

Again, as in the education-intelligence relationship, the analysis of occupational demands in terms of verbal ability is based on actual, functioning reasoning ability, not in any sense on native potential. As the standard of living increases with more education becoming available, and as the occupational structure changes because new jobs develop and others become obsolete, the figures on the number of people who are occupationally underplaced will be outdated. The figures would also become obsolete if at any time the actual composition of the labor force should change, as would occur, for instance, if the difficulty level in the school system were raised requiring many students of lower intelligence to enter the labor force.

Methodology

In establishing the minimum level of intelligence required for performance at the various occupational levels, I have employed the occupational classification system outlined in Chapter III.

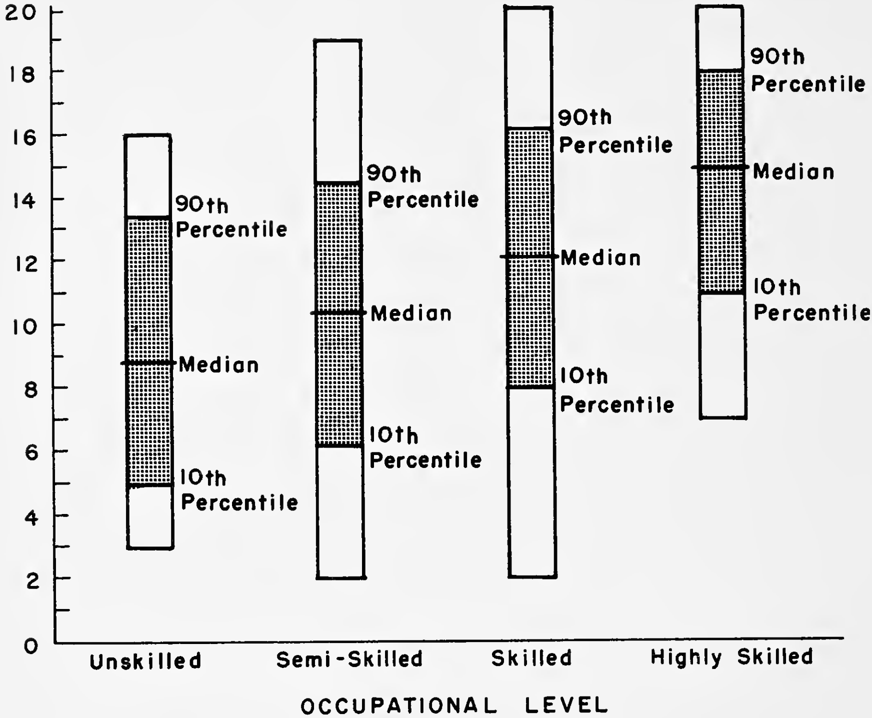

Fig. 5 Vocabulary Score Distributions for Different Occupational Levels

The 745 individuals who were employed at the time they were interviewed were selected in such a way as to match the best available data from the Bureau of the Census. Not only is the number 745 representative of the number of employed people in the population, but the number of individuals in each category of employment was selected to match perfectly the Census estimates. The individual occupations, which had originally been classfied in terms of the schema set up by the Bureau of the Census, were then reclassified in terms of a four-level system based on intelligence demand. The results are presented in the Appendix. The vocabulary score distributions for the four levels—with 10th percentile points, medians, 90th percentile points, and ranges indicated—are depicted in Figure 5.

As was done in determining educational overplacement, the 10th percentile point was selected as the lower bound for adequate performance at each level. Thus, anyone scoring eleven or above

was deemed intellectually capable of working in a highly skilled job. A score of eight or more would warrant placement at the skilled level, and thereby the range through ten was established as defining those who could work at a skilled occupation but no higher. Similarly, a score of seven comes directly above the tenth percentile point of the semi-skilled workers, and accordingly anyone with a score of seven may be considered as capable of semi-skilled work but not of skilled or highly skilled jobs. Anyone with six or less words correct is, by exclusion, intelligent enough only for unskilled labor.

In selecting the 10th percentile point as the best estimate of the minimum intelligence required for each level, a constant error in the direction of underestimating the number of workers who are underplaced is introduced. As indicated in the previous chapter, this procedure seems warranted as a precaution against the effects of random fluctuation of the lowest score in the distribution. The value of this approach is apparent in Figure 5 where the lowest score of an unskilled worker is three, while two is obtained in both the semi-skilled groups. These low scores are random deviations from the minimum of four that represents the best estimate of the result of chance alone when an individual *knows none* of the words. The use of the 10th percentile point as a lower bound does introduce a small number of individuals, 8.3 percent of the employed, who are technically overplaced in that they do not have the minimum intelligence set for their employment level. These people have been treated as though they were sufficiently intelligent to perform adequately at their present jobs, as they may well be; the standards for promotion, therefore, are above those for continued performance at the same job. The overplaced group could conceivably be treated as a separate category. Since the group is small and is defined in essentially an arbitrary manner, it seems best not to attempt to present data on what may be termed occupational overachievers.

The Utilization of the Intelligence of the Employed

Based on the procedures just indicated, it appears that at least 66.6 per cent of all workers have the intellectual potential for jobs at a higher level than that at which they are presently employed. Of those in unskilled jobs, 28.0 per cent have the intelligence required for highly skilled work, another 35.6 per cent seem capable

of skilled jobs, and an additional 11.4 per cent could be raised one level to the semi-skilled category. At the semi-skilled level underplacement is even more prevalent. Promotion to highly skilled jobs seems warranted, on the basis of an intelligence criterion alone, for 47.9 per cent of the semi-skilled; another 33.2 per cent are capable of skilled work. Of the skilled workers, 69.9 per cent could handle the intellectual demands of jobs at the highly skilled level. Comparing the distribution of worker potential with actual employment reveals that 56.6 per cent of all workers have the intelligence for highly skilled jobs while only 12.2 per cent are employed at that level. The situation is reversed at the three lower levels: 26.8 per cent of the employed are capable of skilled work but not highly skilled, while 31.7 per cent are occupied at the skilled level; 6 per cent of all workers are capable of semi-skilled jobs but not of jobs at levels above, while 38.4 per cent have semi-skilled positions; and 10.5 per cent do not have the intelligence for anything but unskilled labor, while 17.7 per cent of the employed actually work at such jobs.

In Table XX the results of an analysis to determine the effects of various background variables on underplacement are presented. The procedure was the same as that employed in the preceding chapter. The chi-squares are based on a division of each category into two cells, one containing the frequency of underplacement and the other containing the frequency of non-underplacement which includes correct placement and overplacement; the latter refers to the workers below the 10th percentile point on any of the distributions for the three higher levels. Over-all tests were first made to determine whether or not there was an association between each background variable and underplacement. If this chi-square value, based on a number of degrees of freedom that was determined by the number of categories employed for the particular variable, was significant, then each individual proportion was compared with every other. This technique reduced the possibility of obtaining seemingly significant differences that were merely a result of the large number of comparisons made between individual categories. Only two variables, education and class, were definitely associated with underplacement, both with probabilities beyond the .001 level.

The most striking results come from the analysis in terms of education. Of the workers with six years of education or less,

TABLE XX UTILIZATION WITHIN THE LABOR-FORCE

The reliability of association between background variables and intelligence to perform at a higher occupational level.

Background Variable	d.f.	χ^2	P
Education	5	84.08	<.001
Race	1	2.92	<.10
Class	3	28.34	<.001
Sex	1	1.48	>.10
Age	6	2.03	>.10
Rural-Urban Residence	5	9.29	<.10
Geographical Area	7	13.07	<.10
Religion	3	2.96	>.10

57.7 per cent have the intellectual potential for higher level jobs. The figure rises to 74.8 per cent for those who have completed seven or eight years, and to 80.1 per cent for those who finished one year of high school but did not graduate. There is a slight drop, to 74.4 per cent, for the high school graduates and a more precipitous one, to 60.6 per cent, for those who completed the freshman year of college but not the senior year. Of the college graduates only 23.5 per cent are capable intellectually of higher level employment. When the chi-square technique is applied to the individual comparisons, those with six years or less completed are reliably below the seven to eight group with chi-square of 8.65 ($P<.01$), the nine to eleven group with a chi-square of 15.83 ($P<.001$), and the high school graduates with a chi-square of 9.14 ($P<.01$). At the upper end of the educational ladder the college graduate percentage is significantly below all other groups. In every case the probability is beyond the .001 level, the chi-squares for the individual comparisons being 20.18 for those with six years or less completed, 46.28 for those with seven or eight years, 61.02 for those with nine through eleven years, 51.08 for the high school graduates, and 17.39 for those with thirteen through fifteen years. In addition, the figure of 60.6 per cent obtained for the college incomplete category is significantly less than the peak value of 80.1 per cent in the high school incomplete group ($\chi^2 = 8.08$, $P<.01$).

It would appear that the utilization of college graduates is, relative to other educational groups, quite good. Most college graduates not only have the intelligence for highly skilled positions but do in fact obtain such jobs. The amount of manpower

wastage for all other educational groups is sizable. Probably the most surprising thing is the marked difference between the two college groups: college incomplete and college graduate. With a college degree the probability of getting a highly skilled job is sizable. Without the degree, even though the average intelligence of the two groups is not very different, the chances of getting a high level job are markedly reduced. Presumably this is, in part, a function of the premium that our society places on the degree, in part, a reflection of motivational factors that determine not only whether or not an individual will finish college but also whether or not he will obtain a job commensurate with his ability.

In the lowest educational group, the reduced percentage of people employed in positions below the level of which they are intellectually capable suggests that, at least, for a number of these people, low education and relatively low intelligence have acted to restrict the level of employment. The individuals who score very low in intelligence and who are working at unskilled jobs are not sufficiently numerous to account for all of the cases that are correctly placed, but there are enough of them to account for much of the difference between this educational level and the three above it. The most pronounced degree of underplacement occurs in those with seven through twelve years of education. The greatest amount of wastage of our human resources is found in this middle range of education.

The findings with regard to subjective class identification are consistent with expectations. In the lower class group 82.8 per cent are underplaced; in the working class, 72.4 per cent; in the middle class, 57.5 per cent; and in the upper class, 31.3 per cent. The employed population divides sharply into two groups, with the lower class being reliably above both the middle class ($\chi^2 = 5.82$, $P < .02$) and the upper class ($\chi^2 = 9.75$, $P < .01$) and with the working class percentage exceeding both the middle and upper class values, at beyond the .001 level, with chi-squares of 15.21 and 11.00, respectively. That the middle and upper class people attain more frequently an occupational level consistent with their intelligence, is presumably a function of class attitudes toward occupational achievement and of differences in opportunity. Working and lower class individuals do, as has frequently been claimed, fall well below the middle and upper classes in the competition for jobs. To what extent this is a result of character-

istics of our social system that keep those with a lower or working class identification from jobs commensurate with their intelligence and to what extent it results from class attitudes and individual motivation can not be specified from the present data. The results are even more striking in view of the fact that the average intelligence of the upper class group falls between that for the lower and working classes and is reliably below that for the middle class. Futhermore, many of this upper class group meet few of the usual criteria for upper class membership. Nevertheless, they do appear to be sufficiently motivated to obtain, frequently, jobs at a level commensurate with their intelligence. As previously indicated, it may be a similar motivation that leads them to claim upper class membership.

Utilization of Groups Outside the Labor Force

During World War II when there was a sharp increase in the demand for manpower, the labor force was augmented by the addition of housewives, the aged, and many who had previously been unemployed. New training procedures were instituted, and extensive revisions of the jobs themselves were carried out in order to absorb these new workers into the war effort. The primary source of additional manpower was the housewife below the age of sixty-five. In addition, many men who would otherwise have retired continued in their jobs until the end of the war. If, as seems probable, the manpower demands of another war should become greater than those of World War II, we may have to turn to other population groups, such as aged women and students, to fulfill the requirements of the emergency. As of 1952, over 25 per cent of the married women were employed, a figure which exceeds that of 21.7 per cent during the *peak* war year, 1944 (11). If this trend in the employment of married women continues, the potential value of the group as a reserve labor pool for emergency purposes will be reduced; other sources may be required.

One criterion of the potential value of these groups outside of the labor force is the extent to which they deviate from the present employed population in terms of intelligence. It is important to know for each of these groups to what extent they can, if required, contribute to the labor force at each occupational level. The figures presented in Table XXI show how the students, house-

TABLE XXI INTELLECTUAL POTENTIAL AND THE LEVEL OF EMPLOYMENT

A comparison of various groups outside the labor force with the labor force in terms of the percentage of each group possessing the intelligence to work at each occupational level.

Group	N	Level of Employability			
		Highly Skilled	Skilled	Semi-skilled	Unskilled
Employed	745	56.6%	26.8%	6.0%	10.5%
Students	251	40.6	34.7	11.6	13.1
Housewives (under 65)	375	51.5	30.9	7.7	9.9
Housewives (65 and over)	48	52.1	39.6	6.3	2.1
Retired	58	53.4	19.0	10.3	17.2

wives under age 65, housewives 65 and over, and the retired compare with the employed group in terms of the percentage of people whose intelligence would warrant employment at each job level. The unemployed sample was omitted as too small to yield reliable data. The individual percentages for the retired and housewives 65 and over are based on rather small samples and therefore would, presumably, fluctuate more than the other values, in subsequent samples drawn from the same population.

Applying chi-square techniques, with three degrees of freedom, to the individual comparisons reveals that only the students with a value of 21.96 ($P<.001$) differ reliably from those who are presently employed. If all students had to be taken out of the schools and put to work, and this would be done only in the most extreme emergency, the proportion of students who would be intellectually restricted to the skilled, semi-skilled, and unskilled levels would be much higher than in the employed group and there would be a corresponding reduction in those who could do highly skilled work. This is to be expected, because a large number of students are in the lower age groups and their reasoning ability is still developing at a relatively rapid rate. The other comparisons with the working group, none of which yield reliable values, result in chi-squares of 3.82 for housewives under 65, of 6.01 for housewives 65 and over, and of 5.37 for the retired. Thus, all groups outside the labor force, other than students, could be absorbed into the labor force without shifting the proportion of workers capable of each level of employment.

The results are based on the intelligence criterion alone and do not in any sense reflect the effects of such factors as physical defects among the aged, the amount of prior training in different types of jobs, and the fact that many housewives at the younger age levels withdraw from the labor force to have children.

One of the most striking features of the analysis is the lack of any decline in potential level of employability in the two aged groups. Although illness and physical defects are presumably relatively high, there are without doubt many old people capable of further work. In addition, among the retired there are many who have a great deal of accumulated knowledge. The problems of utilization of older people are particularly important because, as Wolfle(199) points out, their proportion in the population is continuously increasing as health standards are raised; if the present trend toward forced retirement at age 65 continues, there may come a time when the society can no longer bear the cost of supporting this large segment of the population. As of 1951, the average age of retirement was 69 (119), but there are marked differences in retirement tendencies in different groups. Thus, 59 per cent of all rural-farm men 65 and over were in the labor force in 1951, as compared with 41 per cent of the urban men and 37 per cent of the rural-non-farm men of the same age (11). The implication is that large numbers in the latter two groups are physically capable of continued employment, although it may be necessary, as Barkin (12) suggests, to redesign jobs in some cases to take into account such factors as reduced motor and perceptual speed.

The Method Applied to an Intelligence Model for Occupational Placement

The results discussed so far suggest that a large percentage of the employed population is quite capable intellectually of performing at a higher level, and that, if the nature of the various jobs were left unchanged and people promoted to their optimum level, there would be a majority working in highly skilled occupations and comparatively few at lower levels. Since there is no need for such an increase in the number of people at the top of the hierarchy but rather a need for a sufficient number of skilled, semiskilled, and unskilled workers, there is little probability that in the foreseeable future such large-scale promotion will occur. An

alternative, which would eliminate the present waste of our intellectual resources and at the same time by-pass the difficulties of mass promotion, involves a process of selective promotion and demotion that essentially reshuffles the working population to fit a verbal ability model. The probability is that it never will be possible to fulfill the requirements of such a model completely—namely to have all the most intelligent people in highly-skilled jobs, all the next most intelligent in skilled jobs, etc.— even if the effects of class attitudes and personality blocks can be overcome. It might be possible, however, to approach such a model somewhat more closely than at present.

If there were such a reshuffling of the employed segment of our population, it would involve shifting the most intelligent people to the top job level, irrespective of their prior occupations. Within the new level, the job placement would be based on special abilities, personality factors, interests, etc., as at present. Such a transition would have to be gradual, because much retraining would be required. Since there is an implication that the number of jobs at each level will remain essentially the same, it would be necessary to demote a number equal to the number promoted. This might come about by replacing each person who leaves the labor force with a person whose intellectual level is matched with the job. The end result of such a process would be a raising of the minimum level of intelligence for each occupational level; many jobs could be made a good deal more difficult because they would be filled by an intellectually homogeneous group. At the highly skilled level, many individuals in actual fact write their own job specifications and set for themselves the degree of intellectual demand. There is no real upper bound for a physician or business executive or research scientist. The job is as complex intellectually as the individual is willing and able to make it. Having these jobs filled by the most intelligent members of a society would presumably be beneficial to the society.

There is no implication in the foregoing as to how such a reorganization of the occupational structure might be carried out. Vocational guidance, intellectual standards of selection for various types of training courses and educational institutions, the use of intelligence criteria for promotion and hiring by individual personnel directors, and many other approaches might

be combined to achieve a single result. Although the process could be carried out under an authoritarian regime, there is no necessary reason to believe that it would be more successful than in a democratic society. In fact, it is probable that the amount of manpower wastage in the totalitarian countries of the world is, due to political persecution and the necessity for suppressing the more intelligent members of opposition groups, more prevalent than in this country. Unfortunately, cross-cultural studies of this type are lacking; it would be interesting to compare the countries of the world in terms of the degree of manpower wastage as indicated by tests of verbal learning within each culture.

The actual procedure employed in setting up the requirements for a system of occupational placement based on verbal ability is identical with that previously used in the case of education. Ranges were established for each occupational level by counting down from the top of the distribution of vocabulary scores for the employed population and by establishing a cutting point each time the number of cases in any level was exhausted. Thus, subtracting the 91 highly skilled jobs from the top of the distribution established a verbal range of from 16 through 20 as that required to fill all the jobs at this level with the most intelligent workers. Then, counting on down another 236 cases, until the skilled level was exhausted, gave a range of 12 through 15 as that indicating placement in some type of skilled position. At the third level, the semi-skilled, a range of from 8 through 11 resulted from counting down another 286 cases. This leaves the 2 through 7 range as essentially commensurate with unskilled occupations.

In order to determine the extent to which our present occupational placement system produces a deviation from one based entirely on a verbal ability criterion, all that is necessary is to compare an individual's vocabulary score with the ranges that have been established and then determine whether it would be necessary to promote or demote him to ensure his employment at a level consistent with his intelligence. The degree of deviation can then be specified in terms of the percentage of the working population who would have to be promoted to a higher occupational level to attain a perfect intelligence-occupation correlation. An equal number will, of course, have to be demoted in order to keep the number of people working at each level a constant.

The Intelligence Model for Occupational Placement

Since the standards established for each level under a system of occupational placement based on an intelligence criterion alone are much more demanding than when they were derived from existing conditions, one would expect a smaller degree of underplacement. In fact, approximately 29.1 per cent of all workers would have to be promoted one or more levels and an equal number demoted in order to reshuffle the labor force to fit a verbal ability model. Of the unskilled group 3.8 per cent would have to be promoted to the top level, 12.9 per cent to the skilled level, and 47.0 per cent to semi-skilled jobs. Of the semi-skilled, 5.7 per cent would require promotion to highly skilled positions and 28.7 per cent to the skilled level. Similarly, the highly skilled group would have to be augmented by the addition of 14.8 per cent of the skilled workers. In order to keep the number of individuals employed at each occupational level approximately constant, the following demotions would become necessary: 59.4 per cent of the highly skilled group—44.0 per cent to the skilled level, 14.3 per cent to the semi-skilled, and 1.1 per cent to the unskilled; 42 per cent of the skilled workers—33.5 per cent to semi-skilled jobs, and 8.5 per cent to the unskilled; and 18.8 per cent of the semi-skilled to the unskilled.

In Tables XXII and XXIII the results of an analysis to determine what background variables are associated with the pro-

Table XXII Labor Force Utilization and an Intelligence Model for Occupational Placement: Promotion

The reliability of association between background variables and intelligence to perform at a higher occupational level under an intelligence model for occupational placement.

Background Variable	d.f.	χ^2	P
Education	5	9.06	$>.10$
Race	1	.04	$>.10$
Class	3	5.80	$>.10$
Sex	1	7.32	$<.01$
Age	6	3.00	$>.10$
Rural-Urban Residence	5	8.72	$>.10$
Geographical Area	7	12.93	$<.10$
Religion	3	1.84	$>.10$

TABLE XXIII LABOR FORCE UTILIZATION AND AN INTELLIGENCE MODEL FOR OCCUPATIONAL PLACEMENT: DEMOTION

The reliability of association between background variables and intelligence to perform only at a lower occupational level under an intelligence model for occupational placement.

Background Variable	d.f.	χ^2	P
Education	5	15.84	$<.01$
Race	1	1.60	$>.10$
Class	3	10.66	$<.02$
Sex	1	4.82	$<.05$
Age	6	11.40	$<.10$
Rural-Urban Residence	5	4.43	$>.10$
Geographical Area	7	6.37	$>.10$
Religion	3	1.54	$>.10$

motion and demotion requirements are presented. It appears that there would have to be a marked shift in the representation of the two sexes at various levels. Education and class again appear to be significantly associated with occupation; but this time in connection with the demotion requirement rather than, as in the case of actual intelligence demand for each level, with underplacement.

The sex difference is interesting in view of the fact that it did not appear in the measurement of the degree of underplacement under existing condition. Presumably, under present conditions women are able to attain an occupational level commensurate with their intelligence about as frequently as men even though women are barred from specific occupations. At the highest level women tend to be heavily concentrated in teaching, library work, nursing, and social work, but they are nevertheless able to obtain highly skilled jobs. If, however, the demand were to be raised sharply and a higher intelligence required for each level above the lowest, then women would have to be promoted more frequently than men to achieve a perfect correlation between intelligence and occupation. At present, there seem to be more women rather extremely underplaced than men but not a greater number who are underplaced per se. If the employed were reshuffled along intelligence lines, 26.0 per cent of the men would have to be promoted as against 36.1 per cent of the women. On the demotion side, 30.3 per cent of the men would have to obtain jobs at a level below their present one as against 22.2 per cent of the women.

With regard to education, the prior tendency for underplacement to be concentrated in the middle range is still present when measured against a criterion based on intelligence alone, but the effect is reduced to a point at which it can not be considered reliable. On the other hand, 45.6 per cent of the college graduates would have to be demoted, whereas demotions would affect only 28.2 per cent of those with six or less years of schooling, 20.4 per cent of those with seven or eight years, 25.3 per cent of the group who have completed one year of high school but not graduated, 27.8 per cent of the high school graduates, and 30.3 per cent of those who completed the freshman year at college but did not graduate. The difference between the college graduates and those with thirteen through fifteen years of education is not significant, but the comparisons with the other groups are. Comparing the college graduates with the six or less years group gives a chi-square of 5.47 ($P<.02$); with the seven or eight years group a value of 13.28 ($P<.001$); with the nine through eleven years group a value of 7.89 ($P<.01$); with the high school graduates a value of 6.22 ($P<.02$). There seems to be little doubt that many individuals who are not in the most intelligent segment of the population were, nevertheless, sufficiently intelligent to meet the minimum demands for college graduation and highly skilled employment. These people are without doubt intelligent enough to do their jobs as presently defined but there are other people at lower occupational levels who have the potential for bringing a higher degree of reasoning ability and more complex types of learning sets to these relatively crucial positions.

It appears that social class, or at least class identification, is related to demotion but not promotion; the prior tendency for the lower and working classes, however, to be more frequently underplaced is still apparent, even if not reliably so. With regard to demotion, 31.3 per cent of the upper cass, 33.8 per cent of the middle class, 24.9 per cent of the working class, and 10.3 per cent of the lower class would have to be placed in jobs at a lower level if the perfect relationship between intelligence and occupation were to be obtained. Although the upper class value does not differ reliably from any of the others (the N is quite small), there is a clearly significant difference between the middle class and the working ($\chi^2=5.78$, $P<.02$) and lower ($\chi^2=5.64$, $P<.02$) classes. Apparently there is a relationship between middle class

standing and placement above the ocupational level that would be warranted if intelligence were the only criterion for placement. The class identification may, however, be as frequently a function of the jobs as the reverse; many of these people may not consider themselves middle class until they obtain jobs that are somewhat above those held by people of equal intelligence. On the other hand, many middle class people may have a greater opportunity to obtain higher level jobs for which they are no doubt intellectually qualified but not the most qualified.

The Intelligence Model and Groups Outside the Labor Force

Since the problem of obtaining additional manpower in times of emergency is an important one and in view of the fact that it may be necessary to keep a greater number of older workers in the labor force, because of our society's inability to support their retirement, it is of interest to determine the level of employability of different groups outside the labor force if a perfect correlation between occupational level and vocabulary score were obtained. This may be done by comparing the intelligence scores for each of the non-employed groups, the students, housewives under 65, housewives 65 and over, and the retired, with the ranges previously established and by determining the percentage of each group that could perform at each occupational level. The results of such an analysis are summarized in Table XXIV.

Table XXIV Intellectual Potential and Level of Employment

A comparison of various groups outside the labor force with the labor force in terms of the percentage of each group possessing the intelligence to work at each occupational level under an intelligence model for occupational placement.

Group	N	Level of Employability			
		Highly Skilled	Skilled	Semi-skilled	Unskilled
Employed	745	12.2%	31.7%	38.4%	17.7%
Students	251	6.0	20.7	48.6	24.7
Housewives (under 65)	375	7.2	34.9	40.3	17.6
Housewives (65 and over)	48	10.4	35.4	45.8	8.3
Retired	58	15.5	22.4	34.5	27.6

Comparing each group that is not part of the labor force with the employed gives, for three degrees of freedom, chi-square values of 27.27 for the student comparison, 7.35 for that involving housewives under 65, 2.76 for that based on housewives 65 and over, and 6.13 for the employed-retired difference. Of these values, only that for students is significant beyond the .05 level. They show a highly reliable tendency ($P<.001$) to be incapable of performing at the higher occupational levels. While the comparison based on actual existing job demands revealed a tendency for fewer students than employed workers to be intellectually capable of highly skilled work, the present analysis, based on somewhat more exacting standards for performance at the three higher levels, reveals that students would contribute proportionately less at both the highly skilled and skilled levels. This is of course, a result of the combined effects of high standards and the fact that young people have not, in general, had the actual exposure to develop learning sets to the level of adults.

CHAPTER 8

IMPLICATIONS FOR VOCATIONAL GUIDANCE, PERSONNEL MANAGEMENT, AND EDUCATION

In the preceding chapters the primary emphasis was on general theoretical and manpower problems with only occasional reference to the implications for vocational guidance, personnel management, and education. In this chapter an attempt will be made to specify these "practical" implications in more detail. The theoretical concepts are reviewed briefly and then applied to vocational guidance and personnel selection. Norms for the 20-item vocabulary test are presented along with suggestions for its use. In drawing conclusions from the data presented in Chapters IV through VII, special emphasis is placed on the social stratification factor in intelligence differences, the age of retirement, adult education, the difficulty of material taught in schools, and methods of obtaining an adequate work force.

A Summary of the Theory

The actual functioning intelligence of an individual can be considered as an outcome of the interaction of three primary variables. The first of these, native potential, is postulated as a single, inherited potentiality for complex reasoning that resides in varying degrees in the neural structure of the human being. What we call intelligence actually refers to the learned resultant of the exposure of the individual to a physical environment (the second variable) in which motivation (the third variable) acts as a catalytic agent. Learning sets are developed to an extent

that depends on the degree of native potential, the richness of the environmental stimulus potential, and the strength of motivation to learn from what the environment provides.

What we commonly call reasoning is probably the outcome of the prior development of complex learning sets to a point at which "one trial" learning is possible. The reasoning ability may be channeled into specific content areas by special interests and by characteristics of the environment to produce a variety of special abilities. Thus, verbal ability, spatial ability, numerical ability, etc., may be thought of as complex networks of learning sets that have been developed through actual exposure to the material in the respective content areas. Because of societal pressures and the tendency for environments to be characteristically rich or barren throughout, there is a marked tendency for these special abilities to be developed together, relatively highly in some individuals and less well in others. The empirical results available suggest that for the content areas that are emphasized in our culture correlations between abilities in the population as a whole range from .40 to .90, with the majority of the values falling in the sixties and low seventies One might expect that culturally disapproved or culturally unrewarded abilities will show much lower correlations. Accordingly, what the factor analysts have called the "general factor" would appear to be a statistical product of the nature of the environment in which learning occurs and not the *direct* result of some unitary function of the human organism.

The high relationship between abilities plus the heavy verbal weighting of tests of *general intelligence* produces a sizable correlation between these tests and those of vocabulary. The median value obtained in 22 studies was .83, a correlation that is at least as high as that which might be expected between any two comprehensive measures of *general intelligence*. The fact that these intelligence tests place a primary emphasis on verbal learning sets appears to be a result of the structure of our society. In a country that is heavily industralized and that maintains itself by means of complex systems of knowledge, the communication of information is bound to be of the greatest importance. Since verbal learning sets are extensively employed in the transmission and understanding of knowledge in all content spheres and are, in fact, a necessary condition for the de-

velopment of many other types of special abilities, verbal ability tends to be highly valued in our culture. This emphasis is reflected in the composition of the tests of *general intelligence.*

As might be expected, the cultural pre-eminence of verbal reasoning is reflected in the school system by what may be considered minimum verbal ability demands for adequate performance at the various grade levels. In the population as a whole, tests of verbal ability are quite effective as predictors of educational attainment, because the degree to which verbal learning sets are developed sets a rough limit on the level an individual can attain. In predicting individual course grades, however, tests of the specific abilities involved become more important. Verbal ability may be considered as the best predictor of educational level and of performance in highly verbal courses. In less verbal courses, verbal ability will continue as a predictor, but its value will be reduced, especially if the group is already highly selected on verbal ability as is the case at the college level.

A similar conceptual model may be used to analyze our occupational structure. There is a rather convincing body of evidence to support the concept that occupations may be placed in a series of levels along a single dimension of verbal ability. Each level appears to have a minimum verbal demand that must at least be equalled for adequate performance. At any given level in the occupational hierarchy, abilities other than the verbal become important for predicting success in specific jobs depending on their nature. But to predict the occupational level itself (at which an individual can perform effectively), a test of verbal ability such as a vocabulary measure will be most efficient.

Applications of the Theory

The concept of intelligence, as developed here, implies a learning continuum from native potential, at one extreme, to special job skill, at the other. Assuming innate potential as a biological starting point, the first step is the development of intelligence (as measured by standard tests) through a variety of learning experiences. The next level results from exposure to general education and is followed by the development, through special training, of specific job skills. At any point in this continuum—from native potential to measured intelligence, to general educational level, to job skill—wastage may occur. At

the level of innate potential, development through learning may be minimal, and the individual, although capable potentially of high-level performance, may remain at the intellectual level of a child. At present, the degree of underutilization at this point is unmeasurable. Wastage may occur also through a failure to employ the developed intelligence of an individual; he may be placed at too low a level in the educational system or in the occupational structure. This is the factor that the present study attempts to investigate. There may be a failure to employ general education to the best advantage; our sample, for instance, includes two college graduates, one a waiter and the other a machinist. At the level of special skill, malutilization results whenever a person trained for a specific occupation fails to work in that occupation or in one of a higher level; a doctor who does not practice medicine or a nurse who takes a secretarial job.

To spell out all the factors that may contribute to manpower wastage would be almost impossible. Some have already been mentioned: personality characteristics that block learning and the acceptance of responsibility, cultural barriers such as those affecting the Negro, social class values that are reflected in limited ambition, or restricted environmental opportunity. To these might be added procedures that restrict entry into certain occupations, the lack of financial resources to achieve higher educational goals, and so on.

Essentially, it is the role of vocational guidance and personnel selection to overcome the barriers or blocks to effective, optimum manpower utilization. Although vocational guidance centers on the individual person, and personnel selection on the job to be filled, basically there is a common objective: optimum utilization of human resources paralleled by the highest possible rewards to the individual, the employer, and society as a whole. To accomplish this, the guidance counselor or personnel specialist must use all his knowledge of an individual's intelligence, prior education, special skills, and personality characteristics, plus his knowledge of the local and national social structure, to arrive at an occupational recommendation or a job placement.

The conceptual schema, developed in this book, is intended primarily as an aid to optimum utilization at the level of measured intelligence. For personnel practice the crucial requirements are the placing of each job at a specific level in the

hierarchy of verbal demand and the identification of other requisite abilities and personality characteristics; applicants are then evaluated against these criteria. In vocational guidance an individual's level of employability is established first; the more specific abilities and characteristics are then evaluated to determine the occupation or occupations that are most suitable, thus gradually narrowing the number of possible recommendations to a specific few. In the case of personnel selection it is possible to restrict the initial analysis to jobs actually existing in the organization. If all employees or a representative sample can be tested, the method of Chapter VII may be used for setting verbal ability demand levels (and, incidentally, for measuring the degree of underutilization within an organization). The identification of other factors, such as non-verbal mental abilities, motor skills, visual acuity, personality tendencies, would follow. Most of these other factors are currently evaluated in some way by personnel departments. Personality variables, however, are frequently considered in a rather superficial manner, because they are difficult to assess; it might be well to mention that, in my experience, both the Thematic Apperception Test and the Tomkins-Horn Picture Arrangement Test (180) can contribute valuable information to personnel practice.

In view of the data presented in this book on the 20-item, multiple-choice vocabulary test, many readers may wish to use it as an aid in psychological evaluation. The test is reproduced in Fig. 1 (see page 53). Tables XXV and XXVI contain score frequencies (for the total sample, various non-student educational groups, and each age category) derived from the representative sample described in Chapter III; they may be employed as norms for the test. The user is cautioned against employing the norms unless he has obtained an answer to all 20 items. If the subject absolutely refuses to guess, a correction for not guessing may be made as follows:

Number of Items Not Answered	Add to Number Correct
0-2	0
3-7	1
8-12	2
13-17	3
18+	4

TABLE XXV POPULATION AND EDUCATION NORMS

Test Score	Total Sample	Educational Group 0-6	7-8	9-11	12	13-15	16 or more
2	5	3	1				
3	13	8	2				
4	26	15	4		1		
5	47	23	7	4	2		
6	70	23	19	8	6	2	
7	114	21	39	14	10		1
8	131	33	38	17	15	2	
9	156	29	37	34	20	3	3
10	156	25	31	30	31	3	5
11	174	18	32	37	40	9	3
12	150	12	25	35	48	4	4
13	126	10	18	18	51	10	7
14	105	4	14	23	30	14	13
15	76	3	9	6	23	12	12
16	71	3	10	6	19	9	13
17	37	1		1	13	10	10
18	29		4	1	8	5	9
19	8			1	5	1	1
20	6				1	2	3
N	1500	231	290	235	323	86	84

APPLICATIONS OF THE RESULTS

Socio-economic stratification is the factor that is most consistently and impressively related to intelligence. The less well educated, the lower level worker, the Negro, the individual who identifies with the lower classes, all are characteristically far below the rest of the population in intelligence. In part, this is a result of selection; those with limited native potential will in all probability be able to absorb little education and master only elementary occupational skills. In part, this is because environmental opportunity is most restricted and motivation to learn is lowest in these groups, especially among Negroes.

TABLE XXVI AGE NORMS

Test Score	Age Groups 10-13	14-17	18-24	25-34	35-44	45-54	55-64	65 or more
2	1					3		1
3	3			2	1		3	4
4	5	2	1	7	2	1	6	2
5	8	4	4	5	3	6	6	11
6	7	7	7	9	8	13	11	7
7	18	13	14	17	14	19	8	11
8	11	15	12	15	20	24	17	15
9	19	12	20	34	32	12	13	14
10	12	16	24	28	28	25	11	12
11	20	13	19	35	26	20	20	21
12	10	10	19	31	33	16	18	13
13	5	8	9	25	23	12	29	15
14	3	3	7	30	27	18	10	7
15	1	3	9	15	16	16	8	8
16	1	3	7	15	17	11	8	9
17		1	1	8	11	6	6	3
18			3	5	5	12		3
19			1	1	2	3		1
20				1	2	2	1	
N	124	110	157	283	270	219	175	157

The problem seems to be primarily one of education. The individual teacher must in some way overcome the effects of barren environments prior to school entry and instill motivation to learn in children who come without this motivation. This seems to me by far the most difficult factor in present-day American education. If the educational system does not develop the innate potential of the student, it is probably too late to develop it by the time adulthood is reached. Sharp increases in intelligence after the age of 16 are extremely rare. In fact, there are many arguments favoring a lowering of the age of school entry for children of the lower socio-economic levels; this would

increase the probability that native potential will be developed. If the home can not offer the environment and the motivation to learn, then the educational system must do so and thereby minimize the restricting effects of the home. Unfortunately, nursery schools and kindergartens are most frequently used by those who need them least, the upper socio-economic groups. Some method of getting the children of slum districts and poverty-stricken rural areas into good schools by the age of three or four seems to be required.

The finding that intelligence continues to rise throughout adulthood in a large percentage of the population challenges the present trend in personnel practice toward a rigid policy of early retirement. There is much evidence that many older people—not just members of Congress and elder statesmen—prefer to continue working and are physically capable of doing so (119). Add to this the increase in knowledge and in measured intelligence and we have a strong case for continued employment and for a retirement age based on a comprehensive evaluation of each individual relative to the job he performs. In view of the continuing high demand for labor, especially highly skilled and capable workers, it may be more desirable to continue the employment of many older people and, at the same time, increase the educational level of many of those still in school.

In Chapter VI, data were presented dealing with the large number of adults intellectually capable of advancing their education. This situation has already been recognized as evidenced by the rapid expansion of adult education programs. In addition, the G.I. Bill represented a deliberate attempt to get many who had "completed" their education back to school. Industry has recently begun to send some of its management personnel to universities for further education. It is, however, among the older, working class members of society that the largest potential for increased education is found. For this group the adult education programs, although valuable, represent only a partial solution. One recommendation is that business and industry send employees, whose intelligence suggests they would benefit markedly from more education, to school for periods of time. The worker receiving the subsidized education would agree to continue working for the company over a certain number of

years (as is now done in the armed forces). Actually, such a plan would not only work to the long-run benefit of the individual and company concerned but might also stimulate many wives of employees, whose children were of school age or older, to return to their education.

The primary problems raised in Chapter VI deal with the school system itself. It has long been recognized that most school classes contain pupils varying widely in ability. The results presented here give some indication of the extent of this factor in our educational system as a whole. The problem is of increasing urgency. As the educational segregation of Negroes—the result of legislation in the South and of segregated housing in the North—continues to decrease, a large number of low-ability students will be added to classes that are already quite heterogeneous. I am in no position to offer any clear-cut solutions. It does seem, however, that sooner or later we will have to start raising the difficulty level of the material taught in school. Too many students are now drifting through their education without being forced to utilize their intelligence to the fullest until they reach the college or graduate school level, if they go that far. Much material now taught in high school could be shifted to the grade school, and college subject matter to the high school curriculum. There is certainly no dearth of knowledge of a more advanced nature to round out college and graduate courses. The teacher, of course, would have to possess more subject-matter knowledge at every educational level than is now necessary.

Because under the current system of grade placement many of the less intelligent students in each grade would not be able to learn the new material in the time allotted, raising the difficulty level almost necessitates either a strict achievement policy in promoting from one grade to another or the subdivision of each grade into different learning-speed groups. The present trend toward special sections for the gifted does not offer an adequate solution because, according to the data presented in Chapter VI, over half of most classes should be in these special sections. We do not, and probably never will, have enough teachers and classrooms to break each grade into a variety of special sections, particularly not in rural areas. Perhaps the

best solution is an achievement-based criterion for promotion. The material to be taught is graded in difficulty with the easiest presented in the earlier grades. When a student reaches a certain level of learning he is promoted. If he does not learn the material the first time, it is probable that with added time he will be able to learn it. There is a limit, however, to the number of times a grade can be repeated with positive results. Motivation to learn may well disappear after the second or third try. In such cases, since promotion would be pointless, the child probably should be withdrawn from school. If the difficulty occurs at the lower levels (the child cannot learn to read or write), he should either be given psychotherapy or sent to a school for retarded children, depending on his needs. If the difficulty occurs later when much learning has already taken place, he should probably seek employment. Under such a system the difficulty of the curriculum taught in each grade could be shifted upward. The students in a grade would form a relatively homogeneous group or, at least, they would all be above a certain minimum intelligence. This minimum would rise rather sharply with progression through the educational hierarchy, as less intelligent students repeated grades in order to have the benefits of increased time to learn material that they found difficult. There would remain, of course, the problem of having students of varied age in the same class.

Although the material contained in Chapter VII is relevant to many fields, it will probably be of most immediate interest to personnel managers. Almost any organization can expect to find among its work force a sizable number of employees who have been placed in positions well below their capabilities. In some cases the underutilization could be extreme; a janitor with the intelligence of the company president, a warehouse laborer with the intelligence of the personnel manager himself. True, these people may not have other characteristics that would warrant their eventual placement in some of the *jobs* they might master intellectually, but in most cases some increases in occupational *level* would benefit both the individual and the company.

This situation would appear to recommend some type of talent search to many employers. In a company, a measure such as the 20-item vocabulary test could be used for the initial screening of the total employee group, followed by more intensive

procedures for those of the underutilized group who were interested in advancement. Training programs might be required in some cases or even subsidized formal education.

Wastage of human resources within the labor force is apparently most pronounced in persons with seven through twelve years of education. This is probably a direct result of current personnel practices which place what would appear to be undue emphasis on college education as a requirement for higher level positions. Most personnel managers, without doubt, could find among their less well educated employees and job applicants many whose intellectual level or reasoning ability is far superior to that of the more highly educated group who are now hired.

Another implication derives from the survey procedure itself. Many employers probably are hiring a work force that is below the level of that in the surrounding community. The more intelligent workers, for some reason, do not appear at their personnel offices. In many cases this can be rectified through investigation of the relevant factors and appropriate public relations and other efforts, i.e. changes in working conditions, advertising of openings in different media. Unless the employer is aware of such a situation, he can do nothing to rectify it. In some cases the majority of jobs in a company do not require even an average level of intelligence; more frequently, however, the problem of intelligence is an important one. It should be possible to administer a brief verbal intelligence test to a representative sample of employed people living in the area. The results could then be compared with those obtained among job applicants or the work force itself. Questions dealing with the reasons for seeking certain types of employment opportunities might be included in both community and in-plant interviews. Ideally a number of employers in an area would carry out the study on a cooperative basis.

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INTELLIGENCE DEMAND SYSTEM OF OCCUPATIONAL CLASSIFICATION

Level 1

Top 12.2% of the intelligence distribution consisting primarily of high level professional workers, executives, those involved in the most technical and complex clerical and sales work, and large scale farmers.

Accountant
Agent, insurance
Artist, commercial
Broker, real estate
Chemist, industrial
Claims Investigator, insurance company
Controller, credit office
Dentist
Dietician
Engineer, civil
Engineer, industrial (methods)
Engineer, locomotive
Executive Assistant, large business
Executive, bakery
Executive, bank
Executive Director, Girl Scouts
Executive, publishing company
Executive Secretary
Farmer, large specialized farm
Farm Manager, large specialized farm
Geneticist, plant breeder
Geologist
Judge
Lawyer
Librarian, public library
Manager, branch office of large business
Manager, ice cream business
Manufacturer, small factory
Minister
Nurse, graduate
Office Manager
Officer, Air Force
Officer, Navy
Personnel Manager
Pharmacist
Principal, elementary school
Production Manager, factory
Psychologist, school
Public Relations Manager
Route Manager, large dairy
Sales Manager
Salesman, technical
Social Worker
Songwriter
Teacher, college
Teacher, elementary school
Teacher, high school
Treasurer, manufacturing company
Writer, technical

Level 2

Upper middle 31.7% of the intelligence distribution consisting primarily of most retail managers, the more highly skilled workers, skilled clerical workers, foremen, wholesale salesmen, technicians, lower level professional workers, and relatively large scale farmers.

Assembler, statistical machine (factory)
Assistant Postmaster
Bank Teller
Bookbinder
Bookkeeper
Bus Driver
Buyer and Trucker, livestock
Cabinetmaker
Carpenter
Cashier, restaurant
Cashier, retail store
Chemist's Assistant, drug manufacturing company
Clerk, billing
Clerk, credit
Clerk, detail
Clerk, engineering
Clerk, general office
Clerk, payroll
Clerk, post office
Clerk, receiving
Clerk, stock
Clerk, title examiner
Clerk-typist
Clerk, work order
Conductor, railroad
Dealer, wholesale electric supplies
Dental Technologist
Dentist's Assistant
Dispatcher, railroad
Draftsman, mechanical
Electrician
Engraver
Farmer, farm well above average in size
Forelady, dry cleaning plant
Forelady, textile mill
Foreman, machine tool shop
Foreman, maintenance crew, oil refinery
Foreman, painters, manufacturing company
Foreman, paper company
Foreman, railroad
Group Organizer, community social center
Hostess, welcome wagon
Inspector of Materials, Army
Jeweler
Justice of the Peace
Lineman, electric company
Linotype Operator
Lithographer
Machinist
Mail Carrier, city route
Maintenance Man, air reduction center
Manager, aircraft company warehouse
Manager, grocery store
Manager, liquor store
Manager, newspaper distributing business
Manager, oil well
Manager, restaurant
Manager, service station
Manager, shoe store
Manager, stationery store
Manager, tavern
Manager, trailer court and cabins
Manager, trucking terminal
Mason
Mechanic, aircraft engine
Mechanic, Air Force (NCO)
Mechanic, automobile

Mechanic, factory
Mechanic, linoleum and tile
Merchant, retail
Millwright
Motion Picture Projectionist, movie theater
Optician
Personnel Worker
Photographer
Plumber
Powerman, telephone company
Printer
Radio Technician
Recorder, city government
Repairman, telephone company
Repairman, typewriter
Salesman, real estate
Salesman, travelling wholesale
Sales supervisor, grain store
Secretary, private
Serviceman, air conditioning
Serviceman, gas company
Set-up Man, factory
Singer, professional
Stationary Engineer, nursery
Stenographer
Superintendent, county jail farm
Superintendent, lumber yard
Supervisor, machine shop
Supervisor, order typing department of firm
Supervisor, telephone company
Tailor, own shop
Teacher, kindergarten
Teacher, knitting
Teacher, piano (private lessons)
Ticket Agent, bus company
Timekeeper
Trustee, county government
Undertaker, funeral director
Upholsterer
Watchmaker

Level 3

Lower middle 38.4% of the intelligence distribution consisting primarily of lower level skilled workers, the semi-skilled, routine clerical workers, retail sales clerks, most farmers, and proprietors of relatively simple businesses.

Apprentice, textile mill
Assembly Worker, factory
Attendant, service station
Baker
Barber
Beautician
Bill Collector, gas company
Boiler Fireman, factory
Boilermaker
Bookmobile Driver
Brakeman, railroad
Brick Setter, brick factory
Brush Machine Operator, textile mill
Bus Driver, school bus
Butcher, packing house
Butcher's Apprentice
Cannery Worker
Caretaker, city parks
Carpenter's Apprentice
Caster, metal factory
Caterpillar Tractor Operator
Chauffeur, domestic service
Chemical Operator
Clerk, general (routine office tasks)
Clerk, library
Clerk, mail (business office)
Clerk, shipping
Cook, restaurant, school, hospital
Cupola Tender's Helper, foundry

Cutter Operator, paper box factory
Cylinder Press Operator, printing shop
Day Nursery Operator
Dressmaker
Drop Hammer Operator, steel mill
Electric Crane Operator
Engineer's Helper
Farmer, farm small to average size
Farmer, tenant
Fireman, city government
Folding Machine Operator, factory
Gager, oil field
Garment Cutter, textile manufacturing company
Glass Worker, glass factory
Grinder, grain mill
Group Leader, production (manufacturing company)
Inspector, factory
Knitting Machine Operator, hosiery mill
Landlady, boarding house
Lathe Hand, factory
Leather Worker, leather products factory
Machine Operator, factory
Mail Carrier, rural route
Mail Sorter, post office
Manager, vegetable stand
Mechanic, foundry
Mechanic, general handyman
Mechanic's Helper, factory
Metal Finisher, factory
Miner
Molder, foundry
Munitions Worker, arsenal
Non-commissioned Officer, Army (no special skill)
Office Boy
Ovenman, television factory
Ordnance Plant Worker
Painter, house
Painter, sign
Plumber's Helper
Polisher, metal manufacturing company
Practical Nurse
Pressing Machine Operator, textile manufacturing company
Press Operator, printing office
Pressure Man, gas company
Printer's Apprentice
Printer's Assistant
Produce Man, grocery
Pull-over Operator, shoe factory
Pumper, oil well
Punch Press Operator
Receptionist
Rodman, surveying
Roughneck, oil well
Sales Clerk, florist
Sales Clerk, retail store
Salesman, retail house-to-house
Sawyer, saw mill
Seamstress
Sewing Machine Operator, factory
Sheet Metal Worker
Shoe Cutter, shoe factory
Spring Maker, steel factory
Steelworker, construction
Switch Tender, railroad
Taxicab Driver
Telephone Operator, private switchboard
Telephone Operator, telephone company
Textile Worker, textile mill
Ticket Picker, arsenal
Timber Cutter
Tool and Die Worker
Tree Sprayer
Tree Trimmer
Truck Driver
Truck Driver and Salesman, dairy
Truck Driver and Salesman, laundry
Truck Driver, city government
Washing Machine Operator, laundry
Weaver, cotton mill
Welder, electric arc
Weigher, grain mill

Level 4

Lower 17.7% of the intelligence distribution consisting primarily of unskilled workers.

Automobile Polisher, garage
Baby Sitter
Bagger, lime kiln
Butcher's Helper
Butler, domestic service
Cleaning Woman
Companion
Cook's Helper
Core Rack Tender, foundry
Cowboy
Dishwasher
Finisher, paper box factory
Furnace Cleaner
Garbage Collector
Garbage Truck Helper
Gardener's Helper, domestic service
Housekeeper, domestic service
Janitor
Kitchen Helper, hotel
Laborer, city government
Laborer, construction
Laborer, farm
Laborer, factory
Laborer, lumber mill
Laborer, nursery
Laborer, odd jobs
Laborer, packing house
Laborer, paper company
Laborer, quarry
Laborer, railroad
Laborer, rubber works
Laundress
Loader, foundry
Loader, cannery
Loader, clay mine
Loader, machine shop
Maid, domestic service
Maid, hotel
Mason's Helper
Newsboy
Nursemaid, domestic service
Packer, factory
Porter, hotel
Porter, railroad
Private, Air Force
Stock Girl, farm
Stump Puller
Vegetable Parer, restaurant
Waiter
Waitress

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